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## CASES ILLUSTRATIVE OF THE LOCALIZATION OF THE MENTAL FACULTIES IN THE LEFT PRE-FRONTAL LOBE.

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Attempts to localize the mind in the human body began almost as early as the recognition of its existence. Theories were successively formulated during many centuries which were wholly speculative and often without a vestige of reason, but which followed a logical sequence and led to rational, though usually mistaken, conclusions. The successive steps in this progressive development of an idea were the separation of the moral from the intellectual faculties; their localization in different organs; their recomposition in the brain; the restriction of the mind to a definite seat in some one of the various encephalic regions; and, finally, the assignment of individual mental faculties to separable cerebral areas. The several phases of localization enumerated were not chronologically distinct. During the whole period of from twenty-three to twenty-four centuries as new theories were developed older ones persisted. There could be no settled beliefs because there were no sufficient foundations of fact, and while much of the anatomy of the brain became known, little of its physiology or pathology was discovered.

In the first decade of the nineteenth century a more rational study of cerebral physiology than had been made before was undertaken by Gall, who was also the first to conceive the idea of a methodical plan of cerebral localization. His later work, in collaboration with Spurzheim, which included not only cerebral physiology and anatomy together with cranioscopy, but also psychology, profoundly impressed the minds of his contemporaries and immediate successors. His theory of localization, founded upon a comparison of known or assumed individual

characteristics with the configuration of the cranium, though later proved unsound and repudiated by physiologists, doubtless inspired the remarkable activity in experimental research directed toward the elucidation of cerebral physiology which followed in the early part of the century.

In 1825, Bouillaud, relying upon pathological observations and accepting the methods of Lallemand, who had been the first to systematically and critically study cerebral symptoms with a view to their future comparison with coincident changes in cerebral structure, made the earliest defensible localization of a cerebral function. He had been led by what he had observed in cases of cerebral disease to seek a centre of control for articulate speech. Having become satisfied that intimate relations subsisted between a more or less complete loss of speech and a corresponding alteration of structure in the anterior regions of the brain, he submitted his conclusion to the test of comparison with cases collated by other observers. Whenever, either in his own cases or in others, he discovered loss of speech among symptoms, he later found lesion of the anterior cerebral lobes; whenever he found such a lesion he learned that loss of speech had been a symptom, and there was no exception to this rule. By a similar inductive process of reasoning from ante-mortem and post-mortem observation he determined that the control of muscular movements in general was resident in the posterior regions of the brain. If these early localizations of Bouillaud were less precise than those made for the same important functions in more recent years, it should be borne in mind that cerebral topography then existed only in an elementary form, and that he was unaided by any practical suggestions derived either from previous physiological experiment or from the observations of earlier or contemporary writers. Flourens had not yet published the results of his experimental researches, and previous experimenters had contributed nothing to localization; Andral, who was convinced that paralysis could result from a lesion in any part of the hemispheres, scouted the idea of a connection between loss of speech and lesion of the anterior cerebral lobes; Lallemand believed that nothing had been accomplished in cerebral physiology except by Gall and Spurzheim, whose fanciful theories he accepted with enthusiasm; Haller, Zinn, Lorry, Sabouraut, and all those who wrote about the brain at a still earlier period, were only concerned with its crossed action, without regard to function.

The experiments of Flourens and the observations of Bouillaud were practically synchronous. In 1824, one year earlier than the publication of Bouillaud's treatise,[1] Flourens[2] published his experimental study

[1] Traité Clin. et Phys. de l'enceph., 1825.
[2] Rech. Exper., etc., du Système Nervaux, Paris, 1824.

of the nervous system in the lower animals. His conclusions, so far as the localization of functions in the cerebral lobes is concerned, were more indefinite than those of Bouillaud, and were entirely at variance with them as regarded the inclusion of motor centres of control. As to the intellectual and perceptive faculties, which he believed to constitute but a single faculty, he asserted their conjoint occupancy of the whole cerebrum.

Flourens continued his physiological investigations for twenty years or more, but no important advance was made by him or by other physiologists or pathologists until Broca, in 1861, localized the centre for articulate language in the posterior part of the second or third frontal convolution, and afterward exactly defined it in the posterior part of the third frontal convolution of the left side. This definite localization, like the earlier approximation of Bouillaud, was the result of careful comparison of symptoms with subsequent post-mortem disclosures.[1]

In limiting the centre for articulate speech to a single convolution, Broca believed he had established a principle of localization which has since proved to be true for many faculties. Gall had first recognized the fact that many functions were localized in the brain, but failed in his attempt to establish their locations by an arbitrary delimitation of cranial areas. Bouillaud had only roughly approximated the truth in discovering that the control or exercise of different muscular movements was dependent upon the integrity of different cerebral regions of large and ill-defined extent. Broca believed, as did Aubertin, that if the localization of the faculty of articulate language in one frontal convolution should be substantiated it would establish the general fact that individual faculties are localized in single convolutions. This opinion seemed to be strengthened some years later by the demonstrations of Fritsch and Hitzig that various centres of control were limited not only to single convolutions, but, as in Broca's instance, to parts of convolutions. It is also likely to prove true for some of the special senses, and approximately so for others; but it has failed in establishment as an absolute law.

Broca's announcement of his discovery of a special centre for articulate language was at once challenged by his contemporaries, and was for some years a storm-centre of discussion. Aubertin accepted it without reserve as true. Trousseau, on the strength of a single case of left hemiplegia with loss of speech, unverified by necropsy, pronounced it to be not only unwarranted in fact, but entirely opposed to physiological principles. Hughlings Jackson, in 1864, after a judicial summary of the various considerations which favored and opposed Broca's conclusion, declared himself to stand on neutral ground.[2]

[1] P. Broca. Bull. de la Soc. Anat., August, 1861.

[2] Diseases of the Nervous System. London Hospital Reports, 1864, vol. i. p. 460.

To-day no fact in cerebral localization is more absolutely unquestioned.

The following decade and the beginning of the next was a period of remarkable and successful activity in this special field of physiological investigation. The only positive and definite localizations made up to that time were those of the respiratory centre in the medulla oblongata and of muscular co-ordination in the cerebellum by Flourens, and of articulate speech in the left frontal lobe by Broca. In 1870 Fritsch and Hitzig, by the application of the galvanic current to the cerebral cortex of dogs, demonstrated centres of control for all the more important muscular movements of the body. In immediately succeeding years Ferrier, Horsley and Schafer, Hughlings Jackson, Putnam, Dalton, Bartholow, Wood, Braun, Goltz, Munk, and a great many other experimentalists and pathologists, repeated, elaborated, and verified the experiments of these observers, and extended the field of cerebral localization until it covered nearly everything in the topographical physiology of the brain which is known at the present time.

The positive results of this work include the determination of centres of control for nearly or quite all the groups of voluntary muscles, for general sensation, and for the more important special sensations of sight and hearing. Some question has been raised as to the correctness of Ferrier's localization of tactile sensation in the gyrus fornicatus and hippocampal region, but the weight of anatomical, pathological, and experimental evidence seems to justify his conclusion.

The evidence which points to centres of control for taste and smell in the hippocampal region is perhaps still insufficient to constitute absolute proof.

The existence of special heat centres—thermogenetic, thermotoxic, and thermolytic—though asserted, and by Wood and Ott localized in various parts of the brain, is still a subject of discussion, as is that of vasomotor and certain other centres.

The question of control of the intellectual and moral faculties—whether they reside in some distinct region of the brain or whether they constitute a function of the brain as a whole—has received less careful investigation, and has been consequently further from solution than any other in cerebral physiology. This has followed, naturally, from the difficulty of interpreting the results both of experiment upon the lower animals and of pathological observation of the human subject. Physiologists and pathologists have differed equally in opinion as to the significance of what they have observed. The two writers of highest authority who have given the subject consideration—Ferrier and Hughlings Jackson—arrived at conclusions which were radically different. This difference may be sufficiently indicated by brief quotations from Ferrier:[1]

[1] Functions of the Brain, second edition, New York, 1886, pp. 427–460.

"The sensory centres are to be regarded not merely as the organs of consciousness of immediate sensory impressions, but as the organic register of their own sensory experiences. This organic memory is the physical basis of retentiveness, and the property of re-excitability is the organic basis of recollection and ideation."

"These sensations are accompanied in consciousness by feelings which are divisible into two great and opposite classes of pain and pleasures. Just as sensations are the subjective side of certain physical modifications of the nerves and nerve centres, so pleasurable or painful feelings may be regarded as the subjective expression of physical harmony or disharmony between the organism and the influences acting upon it."

"The various sensations, feelings, and desires, present or revived, singly or in associated combination, form the incentives to action, the motives to volition.

"The motor activities called into play by definite feelings and sensations, present or revived, constitute volitional movements; and the organic cohesion formed between the sensory and motor centres, persistently enduring in these centres, is the physical basis of our intellectual and volitional acquisitions in all their manifold range and complexity.

"We have, therefore, in the cortex centres of sensation and centres of motion, centres of sensory and centres of motor acquisition or registration, an organic sensory and an organic motor memory.

"The motor centres are not merely the centres of impulse, but also the centres of reproduction of volitional movements."

He finally thus summarizes his reasons for dissenting from Jackson's expressed belief in higher centres of mental control:

"It has been assumed by several writers, among others by Hughlings Jackson, that in addition to the sensory and motor substrata which have been demonstrated and defined by physiological and clinical research, there are other higher motor as well as sensory centres, in which all the motor and sensory functions are again represented and form the substrata of the higher mental operations. This hypothesis receives no confirmation from the facts of experiment, nor does it appear to me at all necessary to explain the facts either of normal or abnormal mentation. We have in the sensory and motor centres of the cortex the substrata of the respective forms of sensory perception and ideation, and of the individual acts of volition, simple and compound, as well as of the feelings associated with their activity. It seems more reasonable to suppose that there may be higher and lower degrees of complexity or evolution in the same centres than to assume the separate existence of more highly evolved centres, for which no evidence is obtained by the results of experimental research."

These higher centres, which were described by Hughlings Jackson as at once "the least organized, the most complex, and the most volun-

tary," the highest of evolution, and "potentially the whole organism," were, he thought, "shown by facts to be in the forepart of the brain, which serves in the motor aspect of the mind and represents the movements of all parts of the body."[1]

The quotations, however inadequate they may be as an expression of the general conclusions of these authors, will serve to show their divergence of opinion in regard to the localization of the intellectual faculties.

Those who for whatever reasons believe, as does Hughlings Jackson, that there are higher centres which form the substrata for the higher mental operations, have without exception, like him, placed them in the frontal lobes. As the posterior portion of the frontal convolutions has been demonstrated to control special motor functions, including the co-ordination of muscles of articulation, mental control, if resident at all in the frontal lobes, must be localized in their prefrontal region.

Previous to the publication which I made in 1894[2] of some personal observations of traumatic cerebral lesions no attempt had been made to more specifically localize centres for control of the mental faculties; nor have there been such attempts since that time, so far as I know, by any other writer. In this and in a later publication[3] an analysis of a considerable number of cases in which injury had been essentially limited to one or both frontal lobes led to the conclusion not only that such control probably resided in the prefrontal region, but that it was in the left, to the exclusion of the right lobe. In a series of 225 necropsies there were included 72 instances of laceration of one or both frontal lobes, exclusive of cases of pistol-shot wounds in which almost instantaneous death precluded history. In 33 cases morbid mental conditions were inappreciable by reason of primary and permanent unconsciousness; and in 11 others an early fatal issue, preceded by only partial consciousness or by the existence of delirium from the general cortical lesion, made the recognition of indications of the local injury equally impossible; 28 cases remained in which the attendant conditions permitted an estimate of the direct results of frontal lesion. These comprised:

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|---|---|
| Laceration of left frontal lobe . . . . . | 11 |
| " " right frontal lobe . . . . . | 7 |
| " " both frontal lobes . . . . . | 10 |

These cases were detailed and also summarized. In a second edition of the same work 11 cases subsequently observed were also summarized and were added to the first series, making an aggregate of 16 lacera-

[1] Evolution and Dissolution of the Nervous System. British Med. Journ., March and April, 1884.

[2] New York Med. Journ., November 10, 1894, to January 12, 1895.

[3] Traumatic Injuries of the Brain, etc. New York, 1897, 1900.

tions of the left, 8 of the right frontal lobe, and 15 of both lobes together. I shall quote largely from a summary of the lesions as observed in the first series of 28 cases.

The associated lesions were disregarded as limited to areas of the brain which had been already demonstrated to have other physiological relations or to have no relation to the exercise of the mental faculties.

The lacerations were not always of the same character, situation, or extent. All but 1 involved the anterior region of the lobe; 13 had led to a more or less complete disintegration, either directly or as an effect of hemorrhages; 13 of the cortical injuries were confined to the base, and the 2 others were wholly or in part upon the antero-superior surface. The lesions were cortical and subcortical in case of either lobe, and when both lobes were implicated the dual injuries were usually of the same character. The symptoms held some relation to the situation and extent of the lesion. In the subcortical excavations and disintegrations there was abrogation of mental power rather than aberration in its manifestations, the patient's condition being sluggish and apathetic. In the cortical lacerations, in place of apparent default of intelligence, there were perverted memory, lack of attention and control, incoherence, delusions, or the stupor which comes from confusion rather than from paucity of ideas; the mind was alert to external impressions, though they were not always rightly comprehended. These distinctions, which are general, are by no means absolute. The localizing symptoms were naturally less pronounced or absent in cases in which the frontal lesion was trivial or in which, from the severity of the local injury, death occurred at an early period; this, however, did not prove to be the fact in every case. If recovery ensued the longer duration of symptoms should similarly increase the probability of determining with certainty the presence or absence of specific mental disorder. This inference is justified in several of the appended histories, in some of which the exact frontal lesion was well assured or positively ascertained.

The converse proposition—that laceration of the left frontal lobe is the sole traumatic lesion which occasions a direct loss or derangement of intellectual function—is, so far as can be judged from a study of the same series of cases, only a little less absolutely true. In the 225 necropsies death had been preceded by such deficiency or derangement in 4 instances in which this injury was not disclosed. In 1 of these—a case of pistol-shot wound of a parietal lobe—some slowness of comprehension was added to an hysterical melancholia, which had led to a suicidal attempt. This may be properly excluded, as mental disease existed before the reception of the injury. In each of the other 3 mental decadence was evident; in 2 general hyperæmia and œdema were excessive, and in the third a large localized subarachnoid serous

effusion compressed the frontal lobes. These exceptional cases are scarcely more than 2 per cent. of the whole number of fatal intracranial injuries verified by necropsy, in which the frontal lobes were not the seat of destructive injury; and in them those lobes, though not wounded, were in 1 instance the only parts affected by a limited compressing lesion, and in the other 2 were included in a general lesion of excessive severity. There were no instances in which a laceration of any other cerebral region was attended by characteristic mental changes.

In the second series, consisting of 11 cases, the lesion in each was laceration; in 1 it terminated in abscess, and in all but 1 involved the anterior or middle region of the frontal lobe or lobes; in 4 the lesion was confined to the base, in 1 to the deeper part of the subcortex, and in the rest to the superior convolutions. They all followed the rule established in the earlier series, that the deeper the laceration, and therefore the more destructive the injury, the more mental default preponderated over mental aberration. In line with this observation is the fact that in the recovering cases, which from the symptoms were presumably cases of frontal lesion, mental aberration was more frequently noted than mental default. As the patients recovered, it may be assumed that the lesion was less severe, and therefore irritant rather than destructive.

The salient points in each of the foregoing 39 cases, as before stated, were noted in brief and afterward summarized in the work before mentioned, *Injuries of the Brain, etc.* Still later cases increase the number of the writer's personal observations of frontal lesions verified by necropsy to 46. The whole number of these more recent cases, together with those included in the second series and previously unpublished, are here described in detail.

CASE I. *Cerebral tumor confined to the left frontal lobe.*—The patient, a Russian, aged thirty-two years, was transferred by Dr. Joseph B. Bissell from the insane pavilion of Bellevue Hospital to my care in the fourth surgical division. His mental condition was so far disordered that his history could be learned only from an account given by his wife, who was a woman of intelligence. She stated that he had been a man of irreproachable habits, who never drank or smoked; that he was well educated, speaking and writing four languages; was studious and an accomplished musician, holding the position of first violin in an orchestra of note; and that he never suffered from any sort of previous illness. She further stated that about eight weeks prior to admission he began to have constant headache referred to the inferior occipital region, and to show at times some uncertainty of gait, which was unilateral, but not always on the same side; that he became slow of apprehension, sometimes using the wrong word in writing, but immediately correcting himself; called things by the wrong names; mixed German with English speech; was incoherent, and, though he could read, could not write, misspelling and repeating words and mixing languages as he did in speech; that about the same time he began to suffer from

attacks of vomiting, and that these continued for about six weeks; that a week later his speech became difficult; that a little later still he became utterly unable to speak intelligibly or to write in any language, and lost all interest in his surroundings; that his mental condition was one of apathy rather than of despondency; and as in consequence he paid no attention to what was read to him, and never resorted to his violin, it was impossible to know whether he could comprehend what was read or whether he retained any power of musical expression; that five weeks later he began to talk irrationally; that his memory failed; and, finally, that he had seen everything in a red light with his right eye from the first, but that vision was otherwise unimpaired. This chromatic defect was obviated by the wearing of a black glass over the affected eye. He was somnolent and thick of speech from the beginning of his illness.

On admission to a surgical ward, November 17, 1900, he was well nourished, of rather slender physique, and of refined and delicate appearance. His temperature, pulse, and respiration were normal—98.4° F., 80, 20. He could walk, but with great difficulty, in consequence of a paretic condition of both lower extremities. There was also a barely perceptible paresis of the left side of the face, indicated by a flattening of the nasolabial fold and a slight drooping of the angle of the mouth. The reflexes on the right side were slightly exaggerated, and upon the left side were absent or diminished. The right pupil was slightly dilated, and reacted to light and accommodation. Chromatopsia still persisted; urinary and fecal discharges were controlled; and the urine was of normal character. His mental condition, as then observed, did not afterward essentially change, but its impairment was rapid and progressive. He was drowsy when admitted, as it has been said he had been from the first. He was afterward at times apathetic or lethargic, and these periods increased in frequency as time went on; but he never approached a condition of stupor. He would always respond to questions, and was often even garrulous when aroused. His attention, though readily attracted, could not be held, and consequently his speech was wandering and disconnected—compared by Dr. Peter A. Callan to the prattling of a child. His answers to simple questions which involved but one idea were rational and proper, though their comprehension was usually slow and difficult. His attempts to define or describe were unintelligible, and not infrequently ended in mere meaningless chatter. He suffered from limitation and confusion rather than from distortion of ideas. He had, so far as could be ascertained, no delusions; he was not emotional and was never violent. He always recognized his wife, his attendants, and his surroundings. His memory was defective; it apparently served him from day to day, but he had forgotten where he was born and where he had lived. He had varied forms and degrees of sensory aphasia—alexia, apraxia, and agraphia. He could read neither written nor printed words, though his sight had not suffered. He could recognize many objects when their names were told him, but of others he had no conception either of their names or uses. He could articulate distinctly, and was able to express in speech such ideas as he possessed, but was unable to write either voluntarily or by dictation. He spoke only in the Russian tongue, which, as stated by his wife, he had not spoken before for fourteen years, and, as he indicated to her, thought it queer it had come back to him, and was

annoyed that his efforts to speak in English or German failed. He could still understand either language when it was spoken.

An ophthalmic examination, made four days after his admission to the hospital by Dr. Callan, disclosed descending neuritis in both eyes, with paresis of the right external rectus muscle.

In the progress of the case general symptoms were few. For the first ten days he complained only of his eyes, but he was unable to indicate the nature of this trouble, which it seemed most probable was an orbital pain. At a later period frontal headache was a symptom. From the tenth to the fifteenth day vomiting was frequent. About the twentieth day he began to pass urine in bed, not from lack of control, but, as it seemed, as a matter of convenience; and at a still later period feces were passed in the same manner. His temperature was often normal, never subnormal, and never above 99.6° F. His pulse varied from 68 to 96, and his respiration from 18 to 24. On the day of his death his temperature was 98.6° F. to 98° F., his pulse 64 to 56, and his respiration 18.

Two days before the patient's death a final examination was made by Dr. Alexander Lambert, who noted: "Sensation delayed on the left side and slightly diminished on the right; all reflexes increased; ankle clonus present, more marked on the right side; tremor of hands, especially of right; slight tremor of tongue; vision impaired; patient could correctly count fingers when held before either eye; answered simple questions after some delay; seemed unable to formulate voluntary speech, and could comprehend ideas only slowly, if at all; could not write or read either words or figures; could recognize some objects when told their names, but not others; called nearly everything 'terpsichor.'"

On the day before his death he rather suddenly failed in strength, and on the thirty-first day after admission he died unconscious.

In the belief that the symptoms of mental disorder presented were focal, I made a diagnosis of cerebral tumor occupying the left frontal lobe, and thought it to be confined to that lobe, in default of other localizing symptoms, except amnesic aphasia, which could be accounted for on other grounds. It was conjectured that this tumor was either a glioma or a sarcoma. Abscess was excluded in the absence of previous head injury or of any disease which might have led to infection.

*Necropsy.* Brain, immediate inspection: Cranium and dura mater both notably thin; no indication of either old or recent traumatism or disease; no adhesion of either of the membranes at any point; no subarachnoid effusion; pial vessels moderately distended; left hemisphere larger than the right; median surface of left frontal lobe bulging across the superior longitudinal fissure and slightly indenting corresponding surface of the right lobe; superior surface of the left frontal lobe presenting in its central and anterior portions a distinct prominence, which was of a faint and dull red color as seen through the pial and arachnoid membranes; posterior to this tumor an area extending nearly to the median line and to the precentral lobule, giving a sense of fluctuation; left frontal convolutions broad and flattened, and sulci indistinct.

After a week's interval of immersion in a 2 per cent. solution of formalin, horizontal section of the brain was made through the central plane of ventricles, disclosing a tumor of pinkish color and of moderately firm consistency, strictly confined to the left frontal lobe, three

inches long in its antero-posterior diameter and largely involving the inferior portion of the lobe. Its posterior half was an empty cyst. The left ventricle was displaced inward and backward. The anterior portion of the left caudate nucleus was flattened and pressed backward. Fibres from Broca's convolution were apparently not involved; the entire remainder of the subcortical structure of the left frontal lobe was practically destroyed.

The brain was subsequently submitted to Dr. Harlow Brooks for more minute examination. He made the following report:

"As a whole the brain is large and well formed, and the markings of the two hemispheres are symmetrical. The left lobe is occupied by a well-defined tumor, which distends its inner aspect and appears to be limited to it. The sulci on the right side are deep and the convolutions broad and ample; on the left side the same conditions obtain, except that the convolutions are flattened as though from internal pressure.

"The pia-arachnoid membrane shows no lesion in the hardened specimen with the exception of congestion of the vessels, especially of the veins. The membranes are not adherent to the cortex, not even over the site of the tumor, but the vessels in this immediate region are more injected than elsewhere. The large vessels at the base of the brain show no lesion other than the general congestion and a very moderate degree of arterio-sclerosis. The trunks supplying the deep parts of the brain are in a similar condition, but noticeably less markedly congested, probably from hypostasis.

"The sulci and gyri of the cortex are not typical on either side, and it is therefore difficult to accurately locate the situation of the tumor, although its outlines are distinct, and it is of a different color from the contiguous structures.

"The tumor occupies the anterior two-thirds of the third left frontal gyrus; the triangular portion (Broca's convolution) is entirely free from the growth, though its anterior border has been considerably compressed, atrophied, and forced backward. The superior mid-portion of the gyrus also is not immediately involved, but has been considerably compressed and is displaced upward in its anterior portion. The lower border encroaches to a slight extent on the inferior extremity of the second convolution.

"The surface of the tumor is raised above the general surface of the cortex from 1 to 2 mm. Its boundaries, except in its anterior inferior perimeter, are sharply defined by deep sulci, which have their counterparts in the markings of this region of the right hemisphere. The cortical surface of the tumor also shows sulci similar to those of the like region on the involved side of the brain, except that here they are more shallow. The lower boundary of the neoplasm has invaded the overhanging portion of the left third frontal convolution for the distance of 1 cm.

"The general tissue of the brain presents a normal appearance excepting in those parts invaded or compressed by the neoplasm. The cortical layer of gray matter is thick and regular, but it is differentiated with great difficulty over the surface of the tumor, where the growth seems to have infiltrated, in most places entirely through the surface.

"The greater part of the tumor is made up of a cyst-like cavity which now encloses a considerable mass of fibrin clot. This cyst occupies almost the entire portion of the left frontal lobe, the inner wall of which it has bulged, so that the right hemisphere has been displaced. Its thickest wall is the cortical one, which measures from 2 to 5.5 cm. It is made up of a spongy, highly vascular, neoplastic tissue, which imperceptibly merges with that of the cortex. Internally and laterally the outlines of the cyst are mapped out by a well-defined capsule, varying from 1 to 3 mm. in thickness. The inner surface of this membrane is apparently not of new-growth, but is evidently a thickening of the neuroglia and connective tissue.

"The cavity of the cyst is multilocular. Its inferior portion has excavated the left frontal lobe almost to the cortex. Neoplastic invasion of the brain tissue has taken place only in the external portions of the lobe. The cyst has, however, excavated or displaced so much of the white matter of the frontal lobe that only 3 cm. of the normal tissue bordering on the great median fissure remains. It has also compressed the tissues posterior to it, so that the entire left basal ganglia have been forced backward, and the left internal capsule has been displaced so that it occupies a position almost at right angles to the longitudinal axis of the cerebrum; this has been from the forcing backward of the anterior portions of the putamen and caudate nucleus. The cyst has also intercepted or displaced the efferent fibres from Broca's convolution, and has certainly destroyed all association fibres leaving or passing to the left third frontal convolution. Probably many fibres of the first and second frontal convolutions are also interrupted.

"The cyst does not communicate with any of the ventricles, but its walls have greatly compressed the anterior portion of the left lateral ventricle, with the result that the posterior horn on this side has been considerably dilated.

"Except for moderate dilatation of the ventricles, the medulla, pons, and cerebellum show no gross lesions."

"*Microscopical Examination.* The tissue of the tumor is highly cellular. Its most remarkable characteristic is the presence of true embryonic neural elements. These neuroblasts are not abundant, but a few may be found in nearly every field; they are flask-shaped, and usually have one or more distinct processes, sometimes of considerable length. Often these neuroblastic cells contain several ill-formed nuclei and show irregular karyokinetic figures, as though an attempt at reproduction of the partly differentiated cells was being made. Branching, irregular-shaped cells are much more numerous, and in places can be shown to enter into the formation of an ill-defined stroma like that of the embryological spongioplasm. These differentiated cells do not make up the greater bulk of the tumor, which consists mostly of polymorphic cells and of a stroma resembling the structure of a mixed-cell sarcoma. Vessels are numerous. They are largely poorly formed, and their walls are made up in part by the cells of the growth. Corpora amylacea are frequent in all parts of the tumor; apparently they have been formed from or in the degenerated nervous tissue as the new-growth was displacing it.

"Sections through the cortex of the left third frontal convolution in the invaded portion show no microscopical distinct line of invasion, the growth being apparently an infiltration process, with substitution of tumor tissue for the degenerated neural elements. Neuroblasts are not

frequent in these borders of the tumor, but the sections contain a good many remnants of the original nervous tissue, especially of degenerated ganglion cells, the cytoplasm of some of which still shows the presence of Nissl bodies. The nuclei of several of these ganglion cells show curious arrangements of the chromatin, as though an attempt at mitotic cell division were being made. Some of these cells also exhibit a deposit of amyloid in them; perhaps this accounts for the formation of corpora amylacea, which are found to be frequent in the older portions of the tumor.

"The tumor is a true neuroglioma."

CASE II. *Laceration of left frontal bone.*—Ambulance history: The patient, aged seven years, had been assaulted with the blunt edge of a hatchet, and was unconscious and in extreme shock. The pupils were moderately dilated, reacting to light; breathing slow and stertorous.

On admission to hospital patient was conscious, moaning and irritable; pulse barely perceptible; right arm and leg rigid; slight hemorrhage from mouth; hæmatoma of both orbital regions and of right fronto-parietal region; four small wounds of the scalp made by blows in the left fronto-parietal region, through which a depression of bone could be felt. An incision connecting these wounds disclosed a comminuted fracture of the left parietal and frontal bones involving the coronal suture, from which brain was oozing.

From the first to the fourth days the temperature ranged from 100.6° to 102.2° F., and the pulse from 86 to 66; urinary and fecal control was lost, consciousness was retained; and a little pus was discharged from the anterior portion of the wound.

On the fourth day the temperature rose rather suddenly from 101.4° to 104.6° F. and the pulse from 76 to 106.

On the fifth day the temperature was twice reduced by alcohol baths to 104° F., and each time rose again to 105.2° F. Sensation was diminished upon the whole right side, and the right arm was anæsthetic and markedly paretic.

On the sixth day the range of temperature was 104.2°, 102.8°, and 104.4° F.; range of pulse 94, 128, 98. Convulsive paroxysms involving the right face and the flexor muscles of the right arm occurred at hourly intervals, and there was a loss of power in the right leg.

On the seventh day the convulsive movements extended to the extensors of the left arm and flexors of the right leg, and pus was discharged freely from the wound. The range of temperature was from 103.8° to 105° F.

On the eighth day the convulsions became shorter and less frequent, with rigidity of the left arm during the intervals, and the patient died.

The mental condition remained unchanged from the time consciousness was restored, on admission to the hospital, until its final loss. The patient never moved unless disturbed, never spoke, and never showed any signs of mental action except as he cried out and tried to avoid disturbance. He looked at his mother without sign of recognition. He had no apparent knowledge of urination or of defecation. He lay motionless, with a slight color in his face, breathing gently and with the facies of consciousness, living a merely vegetative existence.

*Necropsy.* Purulent effusion covered both hemispheres and filled the basic fossæ; laceration of the anterior third of the first and of the whole of the second and third left frontal convolutions. Superficial contusion

of the right parietal lobe from the fissure of Sylvius to within three-fourths of an inch of the longitudinal fissure, and of the lower part of the right occipital lobe as far up as the angular gyrus.

CASE III. *Contusion of left frontal lobe, with gunshot fracture of vertex.*—The patient was shot at San Juan, Cuba, July 1, 1898. The bullet fractured the vertex at the left fronto-parietal junction, without penetrating the cranial cavity. He remained five days unconscious in the field hospital. After regaining consciousness he had motor aphasia for sixteen days, but there was no subsequent impairment of speech. No further details of the early history of this case were obtainable beyond the fact that he was trephined. Since that time he had been always conscious of certain mental deficiencies.

He entered St. Vincent's Hospital September 29, 1898, where he remained under observation until November 18th. During this period he presented no symptoms except those of mental decadence. He was slow of comprehension, greatly deficient in power of attention, melancholic, apathetic, and emotional, and his memory of recent events was impaired. He suffered from vertigo when walking, but had no loss of muscular power or co-ordination. His nutrition failed.

The osseous wound was exposed, November 18th, by a semicircular flap which included the periosteum and disclosed the dura mater. The cranial wound of original operation was one and a half inches long antero-posteriorly and one inch wide, and was situated just above the squamous suture crossing the coronal suture, and thus involving both the parietal and the frontal bone. The dura mater was greatly thickened, adherent to the edge of the osseous opening, and without pulsation. After separation of the dura mater from the osseous edge a needle was passed through it into a meningeal cyst, from which one to two drachms of serous fluid was discharged, and dural pulsation was restored. The dural membrane was then incised, and the brain surface thus disclosed was seen to be soft, grayish in color, and non-vascular; and softening was found by the needle to extend one-half inch downward. During the two days following operation the patient declared himself to feel "quite naturally for the first time since the wound was received." On the third day afterward the cerebral wound became infected, apparently from sloughing points in the scalp flap, due to injudicious pressure by compress, and death resulted later from cerebral abscess.

The original lesion was found on necropsy to be confined to the posterior portion of the three frontal convolutions of the left side.

CASE IV. *Laceration of left frontal lobe.*—Patient admitted to hospital in deep coma, with general muscular rigidity and loss of fecal and urinary control. Temperature, 97° F.; no other symptoms. On the following day he was evidently conscious, and, by intelligent movements, attempted to avoid irritations, but would not speak or respond to orders given to him. The pupils and reflexes were normal. Ecchymosis appeared about the right ear. Temperature, 100.2° F. On the third day he answered questions rationally. On the sixth day he at times answered rationally, but was stupid. On the seventh and eighth days he was incoherent, and did not know where he was. On the ninth day he lost consciousness, and on the tenth day he died.

*Necropsy.* Fracture through middle and posterior basic fossæ. Pial hemorrhage over whole of left hemisphere. Deep laceration of anterior third of left frontal lobe, involving the first, second, and third convolu-

tions, one and three-quarters by three-quarter inches in diameter, and filled with a grumous material. Superficial laceration of anterior part of the left temporal lobe. Brain œdematous.

CASE V. *Laceration of left frontal lobe.*—Patient found unconscious in the street. On admission to the hospital he was irritable and irrational, but not delirious. There was free hemorrhage from the left ear. Temperature, 98.8° F.; pulse, 62; respiration, 20. The pupils were moderately dilated; no loss of control of the bladder or rectum. Ten hours later the left arm was convulsed and then became paralyzed and anæsthetic. He also became delirious and lost control of the sphincters. Temperature, 101° F.; pulse, 62. He died on the following day.

*Necropsy.* Dura mater lacerated in left temporal region, and arteria meningia media wounded. Extensive epidural hemorrhage. Laceration of whole superior and lateral aspects of left frontal and temporal lobes. Fracture through left petrous portion and middle basic fossæ.

CASE VI. *Laceration of left frontal lobe.*—The patient, who had fallen down stairs, was entirely unconscious, with slightly contracted pupils, general muscular rigidity, and loss of fecal and urinary control. On the second day he was conscious, but apathetic, and would make no response to questions. There was continued muscular rigidity and lack of control of urine and feces, normal pupils and reflexes, and ecchymosis about the right auditory meatus. On the third day he made only inarticulate answers to questions, and had delusions. From the fourth to the sixth day he was much of the time in a condition of stupor, and was at times rational and at others irrational. From the seventh to the tenth day he was quiet, unable to comprehend his surroundings, sometimes incoherent, and usually confused in his response to questions. On the eleventh day coma supervened; the temperature, which had previously ranged at all times from slightly below to slightly above normal, rose to 104.6° F., and on the twelfth day he died. Muscular rigidity was never relieved. The pulse was usually slow—60 to 70.

*Necropsy.* Linear fracture extending through petrous portion of right temporal into right occipital bone; dura mater thickened and adherent; pial hemorrhage over whole left hemisphere. Laceration of anterior third of left frontal lobe, one and one-quarter inches long and three-quarters of an inch wide, involving the first, second, and third convolutions, extending deep into the lobe, and its cavity containing disintegrated grumous material; small, superficial laceration of each temporal lobe; brain œdematous, with punctate extravasations; no evidence of arachnitis.

This patient was sixty years of age, and was intoxicated at the time he was injured.

CASE VII. *Atrophy of left frontal lobe.*—Patient fell, striking his head upon the curbstone; transient unconsciousness; hemorrhage from right ear; temperature, 97.8° F.; pulse, 80.

Sixth day. Stupor and muttering delirium

Seventh day. Patient very restless—temperature, 99° F.; pulse, 86—at times irrational and at times delirious; comprehended and answered questions, but did not know where he was; temperature, pulse, and respiration normal.

Twelfth day. Patient apathetic.

Thirteenth and fourteenth days. Delirious much of the time; speech thick and difficult to understand.

Fifteenth day. Apathy; no delirium; temperature, 99° F.; pulse, 100.

Seventeenth day. Noticed things; had delusions; at times delirious.

Eighteenth day. Patient rational, but still had delusions.

Nineteenth to twenty-second day. Progressively increasing weakness and apathy, followed by stupor; dysphasia; temperature, 98° to 99° F.

Death on the twenty-fifth day; temperature rose on that day from 102.4° to 109.4° F.

*Necropsy.* Fracture through right petrous portion into middle basic fossæ; no hemorrhages; subarachnoid effusion confined to right side; excessive general cerebral œdema, left frontal lobe much smaller and firmer than the right.

CASE VIII. *Laceration of the left frontal lobe.*—The patient was struck on the right side of the head with the butt of a whip, and immediately became unconscious, but afterward walked to the hospital with assistance. On admission his temperature was 97° F., pulse 80, and respiration 24; he was incoherent and without memory of how he had been injured or of his name or place of residence; his pupils were normal, though sluggish in reaction; and he had slight hemorrhage from the right ear. There was no other external evidence of injury. Later in the day he was restless and at times delirious. On the second day he could give an account of the manner of his injury; a small area of ecchymosis appeared over and below the right mastoid. Temperature, 102.2° F.; pulse, 100.

On the fourth day his mental condition was dull and comprehension difficult, though he answered questions rationally. Hemorrhage from the ear continued in small amount; the pupils were contracted and still sluggish, and mechanical restraint was necessary to keep him in bed. Temperature, 99.2° F.; pulse, 86.

On the fifth day he was dull and apathetic, but could comprehend and answer questions sensibly. Temperature, 99° F.; pulse 78 to 82.

On the eleventh day the mental condition was unchanged except that the patient was more drowsy and stupid; lingual and facial paralysis, which began on the second day, persisted; and vesical and rectal control was impaired.

Thirteenth to fifteenth days. The patient was brighter and more talkative, having numerous and varied delusions; physical condition unchanged. Temperature, 98° to 99° F.; pulse, 62 to 84.

Sixteenth day. The patient was in a state of semi-stupor, and when aroused said he was "simply resting to-day, as yesterday he had worked hard;" or, again, that he had been out to a dance hall. Temperature, 98.2° F.; pulse, 68.

Eighteenth day. The patient was delirious for the first time since the day of his admission. Temperature, 99.6° F.; pulse, 82.

Twentieth day. Delusions continued; patient's mental condition more alert; recognized his wife and attendants; nutrition unimpaired.

Twenty-third day. Mind more active than at any previous time; comprehended and answered simple questions; mastoid ecchymosis barely perceptible; lack of rectal and vesical control continued.

Twenty-fourth to twenty-eighth days. Gradually increasing stupor. Temperature, 98° to 99° F.; pulse, 78 to 86; respiration, 20 to 24.

Twenty-ninth to thirty-first days. Patient difficult to arouse; no other change in symptoms.

Thirty-third day. Patient died. Temperature, 103° F.

*Necropsy.* Fracture through the right petrous portion into posterior basic fossa. Epidural hemorrhage in moderate amount in right temporal region and in posterior fossa. Hemorrhage over left frontal lobe, extending posteriorly over the temporal and inferior parietal regions. Laceration of the left frontal lobe extending through the cortex and involving the first and second frontal convolutions in their middle portion. Moderate cerebral œdema of the right hemisphere and excessive œdema on the left side.

CASE IX. *Laceration of the left frontal lobe.*—The patient was struck upon the head by a tackle-block which had fallen thirty feet. He was found unconscious by the ambulance surgeon, with both pupils widely dilated and irresponsive to light. Temperature, 97.2° F.; pulse, 86; respiration, 26. On admission to the hospital his symptoms were unchanged. A compound comminuted depressed fracture of the left parietal bone extended from its anterior inferior portion to the parietal eminence, and thence to the mastoid process; the cerebral membranes were disintegrated; and hair, dirt, and pieces of scalp and bone were driven into the cerebral substance; and much brain matter had been extruded and lost. The lacerated and disintegrated brain area involved at least the posterior half of the left frontal and upper part of the temporal lobe; just how far the injured area extended anteriorly and inferiorly could not be accurately determined without resorting to unjustifiable exploration. Semi-detached brain matter was cut away and the brain wound made clean; the osseous fragments were elevated or removed, and the scalp was sutured over the osseous opening. Consciousness returned one hour later, and for fifteen minutes the patient muttered and laughed; the pupils were still widely dilated and irresponsive to light and accommodation; the pulse, temperature, and respiration were normal.

On the second day he was irrational and irritable, but not delirious. He was unable to comprehend what was said to him either in English or in Norwegian, his native tongue; his pupils continued widely dilated. There were no symptoms of muscular disorder; pulsating hernia cerebri, one and one half inches in diameter, with an offensive discharge, appeared just above the mastoid process.

On the third day he was more rational and seemed to recognize his friends, but his answers to questions were unintelligible. His speech was mere gibberish, and he laughed and cried at intervals.

On the fourth day he sat up in bed, began to take nourishment by the mouth, recognized his wife and his attendants, was incoherent at times, irritable when aroused from sleep, and still talked gibberish. The hernia cerebri was reduced to about one-half its previous size.

On the fifth day he regained urinary and fecal control, and was more intelligent and less irritable. The hernia cerebri was sloughing and still increasing in size.

On the sixth day he was very restless and irritable, crying or laughing at intervals, but always having a foolish smile.

On the seventh day he could understand English, but could not speak it, and after each effort to do so began to cry; and this was repeated for an hour or more at a time. His pupils were still dilated. During

this week his temperature ranged from 101° to 99° F., and his pulse from 60 to 90.

At the end of the second week, after an intervening period of active delirium, he again became rational, was still very emotional, and could use a few words of English; his pupils were unchanged, and he still wore a perennial and fatuous smile.

At the end of the fifth week his pupils began to respond to light and accommodation, the hernia cerebri had disappeared, and he was less emotional. He could count up to seven, but no farther, could write ten, but not one hundred, and could tell upon demand the name of his wife or of his son.

At the end of three months he could understand speech if uncomplicated and if the words were slowly and distinctly spoken. In response to inquiry he said that if he should return to his work he would be unable to comprehend orders which might be given to him.

Before his injury he usually spoke in the Norwegian language; for a few days after that time, as already stated, his speech was mere gibberish. When he regained speech it was English only; then a little later he remembered a few words of his native tongue; but his Norwegian vocabulary was not afterward increased, though his range of English was perceptibly extended.

At the end of the three months he was still emotional and cried often, though, as his wife stated, she had never heard him cry before he received his injury. She stated also that he took no interest in ordinary affairs. He could not read either English or Norwegian, though he could read both previous to his accident. He could count as far as seven with some instruction and practice, and could write his name and address and spell them correctly. He had entirely lost the memory of some words, and could not repeat words spoken to him, as coat, vest, etc., but could remember the meaning of the greater number of words. He could recognize the name of the town in which he was born, his age, and his occupation. In general, his memory of events occurring during his lifetime was not much impaired. His power of attention was somewhat improving, but his mental powers were generally weakened.

The symptoms in this case, with the exception of the long-continued dilatation and inaction of the pupils, were at all times confined to disorders of the mind and speech.

The patient was a man aged thirty-five years, of robust physique and temperate habits, and was without constitutional taint.

Case X. *Atrophy of both frontal lobes.*—The patient, aged seventy-six years, who all his life had been in perfect health and whose mental condition was unimpaired by age, was thrown from a light wagon while driving. Loss of consciousness was immediate and complete, and continued for fifteen minutes. He then walked to a carriage, in which he was taken to his house. He at first refused to enter, saying that it was not his own, and begged to be taken home. This primary delusion continued until his death, two or more years afterward, and was constant and consistent. On the way home he complained of headache, and vomited once.

When visited by his physician, a little later, his temperature was subnormal and his pulse infrequent—56. His temperature remained subnormal, at about 97° F., for several days, while his pulse progres-

sively increased in frequency to 72. The left frontal region was contused and abraded, and the left orbital region was ecchymotic. He had walked to his room, had no recollection of his accident, and recognized no one that evening but his physician.

During the ensuing six weeks he had no physical symptoms. His temperature was habitually 99° F. and his pulse 72. He had marked mental disorder, a loss of all memory of his accident, and delusions, which were usually of locality, and were absolutely continuous. He had several melancholic attacks, in which he cried and wrung his hands—at one time on account of his fancied absence from home, and at another from apprehensions of disease of various organs or of pecuniary difficulties. He was always coherent; his attention could be fixed; his memory of things which happened before he was hurt remained unimpaired; and his logical processes were always correct, even when his premise was a delusion.

At the end of six weeks loss of fecal control, which had been for a few days occasional, became constant, and for a year or more was not regained; urinary control was retained. At or about this time he awoke one night screaming with pain, which seemed to be in the left frontal region; pulse and temperature were normal. A little later he had a paroxysm of active delirium, which continued for ten days, but still with normal pulse and temperature; and after this his mental condition somewhat deteriorated. His delusions became more varied; he had restless and sleepless nights; his loss of memory of recent events became pronounced, and he was at times incoherent.

At the end of the year he regained fecal control for about three days out of seven.

At the close of the second year no essential change in his condition had occurred. He was in fairly good physical health. His delusions were numerous. His primary delusion that he was away from home never varied, and he was most ingenious in explaining his surroundings upon the basis of its reality, even to the extent that the street in which he lived was duplicated, and that his neighbor's house, which he recognized, had been moved, and that the furnishings of his room had been reproduced in whatever locality he fancied it was in. His other delusions were largely connected with people long since dead, who were still living in his mind. His memory of recent events became entirely lost. His speech was incoherent, hesitating, and indistinct. He had a childish terror of the sound of a wagon, not only when he was in the street, but when in the house he heard it through the windows, though he had been a horseman all his life. His injury had been the result of a collision from behind with a runaway team, and though he never had any recollection of the accident itself, the terrifying impression made upon his mind by the sounds of the wagon and the horses coming upon him had survived. He still recognized his friends, enjoyed their society, and conversed rationally, aside from the delusions.

In the fourth month of the third year after his injury was received he died without the development of new symptoms. His strength failed, and loss of consciousness shortly preceded death.

At no time in the progress of his case was the patient lethargic, apathetic, aphasic, or paretic. His mind was always alert, and after the initial stage he always recognized people, enjoyed conversation, and even maintained a sense of humor.

*Necropsy.* There was a moderate amount of subarachnoid serous effusion. The brain was much atrophied and hardened in its anterior portion, comprising the frontal and anterior half of the temporal lobes.

The results of an examination of the brain and membranes made by Dr. Harlow Brooks is appended.

"The entire dura mater is thickened; the thickening is much more pronounced over the frontal regions, especially the left, where a distinct internal false membrane can be separated from the dura proper. This membrane has an average thickness of 0.5 mm., but in places over the frontal region is as much as 1 to 1.2 mm. thick. It contains numerous congested vessels and spots of recent capillary hemorrhage. There are also many brownish patches over the surface, indicating where previous hemorrhages have taken place. Numerous fine, calcareous particles can be felt in its structure.

"Microscopically, the dura mater proper shows fibrous thickening, and many of the fibres show calcareous degeneration. Its vessels are greatly thickened, and the overgrowth is greatest in the adventitia, though the subendothelial connective tissue is also hyperplastic; calcification of the intima is manifest in many places.

"The subdural membrane is made up of a dense mesh of connective tissue fibrils, many of which are calcified. Bloodvessels, both old and newly formed, are numerous, and there are a great many areas of hemorrhage, some recent, some old, but all apparently of capillary origin. In places the tissues are filled with pigment, no doubt formed by the breaking down and absorption of blood extravasation. The cytoplasm of leucocytes and connective-tissue cells found in the locality of these patches is charged with this pigment.

"Although this membrane is of considerable age, the presence of new capillaries and of recent hemorrhage proves that the membrane is still increasing in thickness.

"The arachnoid membrane is thickened, but its external surface is still almost entirely covered in by endothelium. No adhesions exist between the subdural membrane and the arachnoid.

"The subarachnoid endothelium is incomplete, and the connective-tissue columns which unite the arachnoid to the pia mater are thickened. As a whole, the pia mater is proportionately much more thickened than the arachnoid membrane, due to the perivascular connective-tissue hyperplasia and to the actual hypertrophy of the connective-tissue elements of the vessel walls. In addition there is a formation of new capillaries and other evidences of active connective-tissue hyperplasia.

"The bloodvessels of all the membranes are universally injected; the arteries and capillaries fully as much so as the veins.

"On *gross* examination the atrophied portions of the brain have the appearance of being pressure-atrophies of rather slow formation. The pia mater is adherent to these spots, and on its removal small particles of the cortex adhere. Atrophy is present in both frontal lobes, but is much more marked in the left; yet the convolutions even here can be distinctly traced, though small and of very irregular volume as compared with the corresponding fellow of the right side.

"The bloodvessels throughout the brain, both in the atrophied and in the macroscopically normal portions, show a very marked connec-

tive-tissue thickening, most extreme in the adventitia, but also shown in the subendothelial coat.

"Sections of the atrophied convolutions from the left frontal lobe show the number of capillaries increased; some are apparently of recent formation, and small blood extravasations have taken place through their imperfectly formed walls. This last condition is not general, but is found in small areas only. The neuroglia in these patches is more than usually cellular.

"The outer layer of the cortex of the atrophied convolutions shows a good many spaces of tissue rarefaction very like that which is seen in the molecular layer where great œdema of the membranes is present.

"In the layer of small pyramidal cells the same condition persists, though in less degree. There is a diminution in number of the ganglion cells of this layer. A few of those present show various stages of actual morphological disintegration, while many show both cytoplasmic and nuclear degeneration.

"In the layer of large pyramidal cells changes are not so marked. Disintegration of the ganglion cells is not evident, though some are shrunken and filled with coarse brown pigment. Sections stained with Nissl blue show that most of the cells of this layer have a normal arrangement and staining reaction of the chromophilic plaques; the shrunken cells, however, show cytoplasmic degeneration in various degrees.

"The white matter beneath the atrophied convolutions shows the vascular changes noted above, and also an apparent increase of neuroglia cells, most evident in the immediate proximity of the capillaries or arterioles.

"The basal ganglia and the deep tracts show no evident changes aside from the general vascular lesions; but those portions of the basal nuclei which jut on the ventricles show a maceration of their superficial layers, with erosion of the epithelial covering, probably due to maceration and pressure from the distended ventricles.

"The vascular changes are alike in all the portions of the brain examined.

"The ganglion cell degenerations are found only in the atrophied cortex. The sections examined were from the anterior tip of the left temporosphenoidal lobe and from the left frontal lobe at the angle of demarcation.

"Sections from the left parietal cortex show an apparently normal condition, except for the general vascular changes.

"Doubtless some of the ganglion cell changes are partly post-mortem; but it is beyond question that the larger parts are true degenerations, due to disease processes.

"There is no regularity in the type of cytoplasmic degenerations found in the various sections; perhaps the most frequent alteration is a granular disintegration of the chromophilic bodies, with more or less advanced chromotolysis; cytoplasmic and nuclear chromophilia are notably absent.

"Undoubtedly one of the primary lesions has been a subdural hemorrhage of considerable extent, probably sufficient to cause by direct pressure the atrophy of the frontal and temporosphenoidal lobes. The subdural membrane was formed in the absorption and removal of the clot, and as is usual in membranes of this origin the newly and imper-

fectly formed capillaries were subject to frequent ruptures with resulting hemorrhages.

"I believe that the general arterio-sclerosis, both in the vessels of the membranes and of the cerebral tissues, is a condition independent of the pachymeningitis hæmorrhagica, unless, indeed, it be somewhat of an antecedent, rendering the meningeal vessels more easily ruptured by the traumatism.

"It seems to me that the chronic inflammation of the arachnoid and pial membranes is due to two causes—the presence and pressure of the hemorrhagic exudate, and the general arterial disease.

"The remarkable atrophy of the anterior portions of the brain is, of course, to some extent a pressure atrophy, and the formation of the new capillaries in the affected areas is probably evidence of the method of removal of the compressed tissue. While no doubt the pressure and consequent atrophy had something to do with the destruction of the ganglion cells, it seems more likely that the primary injury produced by the contusion, probably associated with marked intracerebral vascular disturbances, were the most active agents. That there were at the time of injury lesions in the brain tissue is, I think, supported by the proliferation of the subcortical capillaries, and the imperfect nature of these channels is shown by the presence of the minute blood extravasations about them."

In this case the progress of the symptoms can be traced in the light of the post-mortem disclosures. In the first stage they were those of the primary lesion—a general contusion of the brain and the membranes, practically limited to its anterior portion, and more particularly to the left frontal lobe.

In the second stage there were chronic meningeal inflammation, organization of the blood effused in the pial hemorrhage, and a cirrhotic process in the contused portion of the cerebral tissue. The symptoms were still almost exclusively mental, as they had been from the time he reached his own doorstep after the accident. As the structural alterations became more profound, mental aberration became more pronounced, and mental decadence progressively increased.

The loss of rectal while vesical control was retained is not readily explained. It was not due to impairment of the mental faculties, because it occurred while the mind retained its vigor and still controlled the analogous excretory functions, and was in some degree repaired at a later period when the mind had become weakened. There was no loss of consciousness nor a general paralytic condition to which it could be attributed. It may be possible that the rectal and vesical sphincters has each a special and independent centre of control.

CASE XI. *Laceration and contusion of both frontal lobes.*—The patient, who had fallen a distance of from fifteen to twenty feet, was found by the ambulance surgeon in a stupid and irrational condition and in shock. On admission to the hospital he muttered incoherently, answered simple questions, but sometimes irrelevantly, and had nearly normal pulse, temperature, and pupils. During the night he became

delirious, and the following day was more stupid than before, though he could still answer some questions; urinary control was lost, and there was muscular tremor of the right extremities. On the third day he was wildly delirious and had spasmodic movements of the right lower extremity, and exaggerated reflexes. Afterward delirium became less active, spasmodic movements ceased, and both urinary and fecal control was lacking. From the eleventh to the fifteenth days he was semi-conscious and was easily aroused, but would make no response to questions. There was general muscular rigidity, and the pupils were moderately dilated and irresponsive to light. On the seventeenth day he became entirely unconscious, and on the eighteenth day his extremities became relaxed and his neck and arms rigid. His temperature rose to 104°, and he died.

*Necropsy.* No cranial fracture; large subarachnoid serous effusion; slight arachnoid opacity; brain substance œdematous; left lateral ventricle distended with serum; laceration of left prefrontal lobe in sulcus between first and second frontal convolutions, and of right prefrontal lobe at nearly corresponding point, each laceration about one-half inch in diameter and extending to base of cortex; several minute contusions of inferior surface of both frontal and of both temporal lobes, and a deep depression in third right frontal convolution.

CASE XII. *Laceration of both frontal lobes.*—The patient, while intoxicated, fell upon an elevated railway stairway, striking upon his head, and was found by the ambulance surgeon in a condition of stupor; and when aroused was incoherent; no history or indication of chronic alcoholism. On admission to the hospital he was bleeding from the right nostril, was still stupid and incoherent, and had normal pulse, temperature, and pupils. He remained in a condition of stupor, though conscious, until just before his death, on the fourth day. Fecal and urinary control was lost; rigidity of the left side of the neck and right side of the body was well marked; dysphagia was progressive; the corneal reflexes were nearly abolished, and temperature gradually rose to 105.2° F.

*Necropsy.* No fracture; no epidural hemorrhage; thin sheet of cortical hemorrhage covering the whole superior lateral and anterior portions of the brain and the tentorium; cortical hemorrhage in all the basic fossæ, and large in amount in the left anterior and in the right middle and posterior fossæ; laceration of under surface of the left frontal lobe in its whole middle two-fourths, involving the first, second, and third orbital convolutions, and extending deeply into the subcortex; similar cortical and subcortical laceration of inferior surface of right frontal lobe, but somewhat smaller in extent; both these lacerations were filled with clot, which was continuous with the hemorrhagic effusions described. Another laceration extended quite across the inferior surface of the left temporal lobe, and another confined to the cortex involved much of the inferior surface of the right cerebellum. The last was not an apparent source of hemorrhage.

CASE XIII. *Abscess of both frontal lobes from pistol-shot; laceration.*—Bullet of 0.32 calibre entered the head one inch behind and one-half inch above the right external angular process of the frontal bone.

*Primary symptoms.* Hemorrhage from right nostril; blood and brain matter escaping from wound. Patient conscious, but apathetic; pupils contracted and slightly reacting to light; respiration slow and

shallow. Urinary control retained. Temperature 98° F., pulse 76. Fragments of the internal table of bone were removed, and wound healed without suppuration.

*Later symptoms.* None, aside from an abnormal mental condition until the twenty-fourth day, when the patient became unconscious. He was always apathetic, and when sufficiently roused to make answer to questions was incoherent; and his power of comprehension was deficient. Vesical and rectal control were lost with consciousness, and not regained. At about the same time the lower extremities became rigid, and their reflexes were exaggerated.

Death occurred on the thirty-first day. The temperature until the eighteenth day ranged, with two or three exceptions, from 98° to 100° F., and afterward from 102° to 106.2° F., the pulse was ordinarily from 40 to 60.

*Necropsy.* There was no epidural hemorrhage; the dura mater was adherent, and there was a diffused subarachnoid seropurulent effusion. The crista Galli was broken off. Upon section the anterior half of the left frontal and anterior third of the right frontal lobe were each found to contain a large area of thick, creamy material, including fragments of bone and lead. A cylindrical area of softened material one-half inch in diameter extended from the disintegrated portion of the left frontal lobe through the left lateral ventricle to the postero-inferior part of the left occipital lobe, at the termination of which the bullet was lodged, one-half inch below the surface. Small particles of bone and lead and a few grains of powder were found in the left frontal lobe outside the area of disintegration. The frontal sinuses communicated with the cranial cavity and contained a seropurulent fluid.

Case XIV. *Laceration of both frontal lobes.*—Patient found in an unconscious condition. On admission to the hospital there was orbital ecchymosis and subconjunctival hemorrhage on the left side, moderately dilated pupils, and loss of urinary control. He was delirious through the night, and next morning had left hemiplegia. He could answer simple questions, but his attention could not be fixed for a longer time. He recognized his wife with indifference. There was incomplete left hemiplegia, normal pulse and respiration, and slightly elevated temperature. During the first ten days his symptoms were variable. Movement was restored to the left side, but the left arm became and continued rigid; patellar reflexes were lost; rectal and vesical control were regained and lost again; the patient's mental condition was at times apparently normal, at others he was delirious, and at others still he had mild delusions; he was always restless, and his right arm continually moved aimlessly; the pupils were usually, not always, sluggish, and sometimes unsymmetrical, and then the right was the larger. From the tenth to the twenty-sixth day, when he died, he was sometimes delirious, but usually apathetic and without interest in his surroundings. He had many delusions, but often reasoned logically from his false premises. His general condition remained unchanged.

*Necropsy.* Indirect fracture of left orbital plate posteriorly; no epidural hemorrhage; four areas of meningeal contusion, one over each frontal lobe, and one over each parieto-occipital junction, each about two by two and one-half inches in diameter, with opacity of arachnoid membrane and subarachnoid serohemorrhagic effusion; subcortical excavation of whole right and greater part of left frontal lobe filled

with disintegrated clot and extending into motor area on right side; some blood in right lateral ventricles; excessive general hyperæmia.

CASE XV. *Laceration of the right frontal lobe.*—Patient knocked down in a street altercation; later, walked with assistance to police station. He there gave the ambulance surgeon his name and residence, and had sufficient intelligence to give a wrong address. His mental condition was apparently normal. He became comatose when he reached the hospital, and remained so until his death on the fourth day.

*Necropsy.* Acute arachnitis over right hemisphere. Laceration of inferior surface of right frontal lobe posteriorly and involving the corpus striatum and optic thalamus. Comminuted fracture of right orbital plate and of lesser wing of sphenoid bone.

CASE XVI. *Abscess of the right frontal lobe.*—Patient kicked by a horse; when admitted to hospital five hours later was still unconscious. Temperature 97° F., pulse 70, respiration 24. Hemorrhage from both ears. Wound over right eye, one on left side of head, and another between the eyes; the latter involving loss of greater part of nasal bones and of some of the ethmoidal cells; pupils slightly dilated and fixed; loss of vesical and rectal control; spasmodic contractions of various groups of muscles.

Second day. Patient conscious and rational; temperature 98.2° F., pulse 120.

Third day. Patient restless; mental condition normal; said he had no pain; asked intelligently for whatever he required. Temperature rose from 98.5° to 102° F., and pulse from 95 to 122.

Fourth day. Patient restless; had delusions and talked much to himself, but answered questions rationally. Temperature 104.2° F.

Fifth day. Stupor.

Sixth day. Coma and death. Temperature 107.6°; post-mortem, 108.6° F.

*Necropsy.* Fracture of both orbital plates; ethmoid cells disintegrated; no opening into cranial cavity; acute arachnitis, limited to right frontal region; subarachnoid purulent effusion communicating from the vertex with a cerebral abscess situated immediately below the superior cortex and occupying the inner lateral half of the lobe; cerebral tissue about the anterior margin of the abscess blackened and necrotic; brain generally œdematous.

The sudden elevation of temperature and occurrence of mental disorder in this case on the fourth day marked the beginning of meningeal inflammation. These phenomena I have noted elsewhere[1] as diagnostic of the invasion of this process in the course of traumatic injuries. The mental condition was unaffected while the effects of injury were confined to the right frontal lobe.

CASE XVII. *Laceration of the right frontal lobe.*—Pistol-shot wound in right temple. Patient walked five miles to hospital, and on admission was conscious, coherent, and intelligent. No aphasia, no paralysis, no affection of special senses, and no loss of control of sphincters.

On the second day condition unchanged; wound enlarged and frag-

[1] Injuries of the Brain, p. 186.

ments of bone removed from cerebral cortex. Examination was made with view to counter trephination, but it was thought that the ball had been deflected by falx cerebri, and project of operation was abandoned.

On the third day the patient was a little more difficult to rouse, but the facies was intelligent, and he responded rationally to questions.

On the fourth day he became unconscious, and died.

*Necropsy.* Bullet passed through central part of right frontal lobe to median line, and was then deflected by falx cerebri; passed through lateral ventricle, and was lodged in the inferior part of the left occipital lobe, just below the cortex. There was much cortical hemorrhage over the right, and a large subarachnoid serous effusion over the left hemisphere.

CASE XVIII. *Laceration of the right frontal lobe.*—The patient, a boy, aged six years, was struck upon the head by a piece of scantling thrown from the roof of a five-story building. One hour later he was still unconscious and was restless and hyperæsthetic. The skin was warm; the pulse 64, full and regular, and the respiration normal; the pupils were moderately dilated, symmetrical and responsive to light, and the left side was hemiplegic. A pulsating tumor occupied the right fronto-parietal region, through which could be felt a depression of bone. Immediate incision was followed by the escape of disintegrated brain substance, mingled with blood and coagula. The posterior part of the frontal, the anterior half of the parietal, and the upper part of the squamous portion of the temporal bone were broken into fragments, which were greatly depressed and were elevated one by one. Only one bit of bone, not larger than a finger nail, was removed. The flow of blood during this procedure was profuse, and the last fragment elevated was of small size and closed a wound of the superior longitudinal sinus.

In the meantime the patient had become apparently moribund and was resuscitated with some difficulty. A large portion of the right frontal and a small portion of the right parietal and temporal lobes had been removed. On the following day the temperature was 101° F., and the pulse 76; the pupils were moderately dilated, consciousness was regained, and the mental condition was normal, with incomplete left hemiplegia and facial paralysis. A fungus cerebri formed which was not the source of any considerable trouble. The wound was healed at the end of six months, and the paralysis lasted six months longer. During this time his mental condition was absolutely normal; his disposition was cheerful; and his convalescence was unmarked by emotional disturbances.

It is the testimony of his family and their acquaintances, confirmed by the family physician, that for eight years his mental and bodily health was unimpaired. In his fourteenth year he rather suddenly became epileptic, and since then, eighteen years, the paroxysms have been frequent and severe, excited by any mental exertion or excitement. At the present time his memory is good and no mental decadence is apparent. He is, however, irritable and excitable.

RÉSUMÉ. Case I. Symptoms: Almost exclusively mental. Primarily: aphasic disorders and slowness of apprehension. Later: apathy, incoherence, mental aberration, and progressive mental decadence; loss of memory; loss of power of comprehension in general and especially of

comprehending or speaking familiar languages; continued sensory and motor aphasia; and loss of urinary control from enfeeblement of will.

Lesions: Confined to left frontal lobe; tumor excavating and displacing greater part of its white substance, with destruction of much of its cortex; right frontal lobe merely indented; general cortical tissue of brain normal.

Case II. Symptoms: Apparent abolition of all mental action, while consciousness was retained.

Lesions: Laceration of anterior third of first and whole of second and third left frontal convolutions; superficial contusion of right parietal and occipital lobes. Secondarily: acute arachnitis.

Case III. Symptoms: Primarily, temporary motor aphasia; followed by some mental deficiency noted by the subject; later, slowness of comprehension, deficiency of power of attention, apathy, and loss of memory; change of character, patient melancholic and emotional.

Lesions: Gunshot fracture of left frontal and parietal bones; subsequent meningeal cyst; softening of posterior portion of left first, second, and third frontal convolutions.

Case IV. Symptoms: Stupidity, incoherence, and disorders of mentation.

Lesions: Deep laceration of anterior third of left frontal lobe involving first, second, and third convolutions.

Case V. Symptoms: mental condition irrational, but not delirious; later, delirium.

Lesions: Laceration of whole superior and lateral aspects of left frontal and temporal lobes.

Case VI. Symptoms: Apathy, refusal to answer questions, delusions, stupor, incoherence, and deficient comprehension.

Lesions: Deep laceration of first, second, and third left frontal convolutions in anterior third; superficial laceration of temporal lobes; general contusion.

Case VII. Symptoms: Stupor, irrational condition, and inability to comprehend surroundings; apathy and delusions.

Lesions: Atrophy of left frontal lobe, and general œdema.

Case VIII. Symptoms: Incoherence; loss of memory; slowness of comprehension; apathy, and delusions.

Lesions: Laceration of middle portion of first and second left frontal convolutions, extending through cortex; excessive œdema of left hemisphere.

Case IX. Symptoms: Primarily; muttering and laughing delirium, followed by an irrational condition, and lack of comprehension. Later, emotional condition, and speech in unmeaning words; loss of his native language, aphasia, and mental enfeeblement.

Lesions: Laceration and disintegration of posterior half of left frontal lobe and upper part of temporal lobe. Compound fracture of left frontal and parietal bones.

Case X. Symptoms: Primarily, a delusion of locality which became permanent; loss of memory of recent events; further delusions, melancholia, and mental decadence.

Lesions: General atrophy of the anterior half of the cerebral hemisphere, most marked upon the left side, the result of pial and cerebral contusion.

Case XI. Symptoms: Stupidity, incoherence, and refusal to answer questions.

Lesions: Laceration and contusion of both frontal lobes involving first and second convolutions; general contusion.

Case XII. Symptoms: Stupidity and incoherence.

Lesions: Laceration involving middle two-fourths of first, second, and third orbital convolutions, and extending deeply into subcortex. Similar laceration of right frontal lobe somewhat smaller in extent. Superficial lacerations of inferior surface of right temporal and of right cerebellar lobes; cortical hemorrhages.

Case XIII. Symptoms: Apathy; incoherence and deficient power of comprehension.

Lesions: Abscess of anterior half of left frontal, and of anterior third of right frontal lobe; softening in course of bullet track through left lateral ventricle into occipital lobe.

Case XIV. Symptoms: Deficient power of attention and apprehension. Subsequent variable mental condition; sometimes normal, sometimes delirious, usually apathetic, with mild delusions.

Lesions: Subcortical laceration of whole right and of greater part of left frontal lobe; limited meningeal contusions, general cerebral contusion.

Case XV. Symptoms: Mental condition normal till coma ensued on arrival at hospital; answered questions intelligently.

Lesions: Laceration of inferior surface of right frontal lobe, extending to right corpus striatum and optic thalamus; acute arachnitis over right hemisphere.

Case XVI. Mental condition normal till fourth day, when acute arachnitis supervened, with characteristic elevation of temperature and mental disorder.

Lesions: Acute arachnitis, limited to right frontal region, and communicating with a cerebral abscess situated immediately below the cerebral cortex.

Case XVII. Symptoms: Pistol shot wound; patient walked five miles to hospital; conscious, coherent, and intelligent; no mental disorder before final coma on the fourth day.

Lesions: Bullet passed through the middle of the right frontal lobe laterally and then deflected by falx cerebri through left lateral ventricle into left occipital lobe; cortical hemorrhage and limited meningeal contusion.

Case XVIII. Symptoms: No mental disorder at time of injury or for eight years afterward. Patient then became epileptic. At present time he is irritable and excitable, as is usual in cases of long-established epileptic conditions.

Lesions: Disintegration and removal of large part of right frontal and of small portion of right parietal and temporal lobes.

There have been several cases reported of equally extensive and even greater destruction of the right frontal lobe without disturbance of the mental faculties. There is one of Tavignot, quoted by Pitres,[1] in which, by the kick of a horse, this lobe was reduced in its whole extent to a mere mass of granular detritus, though intelligence was preserved and the patient responded to questions with precision. Bramwell[2] exhibited a tumor of the right frontal lobe in a case in which its removal had been followed by a hernia cerebri as large as the head itself, twenty-three inches in circumference by five and one-half inches in depth, destroying almost the whole lobe. The patient lived three years, and "the memory and mental condition remained good." An item in the *New York Medical Record*, 1898, vol. ii., p. 104, calls attention to a case reported by Porta, in which, by an accident, a man lost the whole of his right cerebral hemisphere. He recollected being taken to the hospital; the wound closed in eighteen months, and he recovered with left hemiplegia. "His intellectual functions are said to have been unimpaired." Still another case of serious right frontal lesion without intellectual impairment, one of traumatic abscess, is recorded in Senn's *Principles of Surgery*, 1890, p. 273, and is thus stated: "The patient filled in a creditable manner a responsible and important government position for thirty years, and died from another cause. The necropsy showed an abscess cavity, the size of an orange, located in the anterior right lobe of the brain, which communicated with the external surface through a fistulous opening in the skull."

I shall add to this series of cases two instances of left frontal lesion reported by other observers, the records of which are so full in detail and so accurate in statement as to give them unusual value.

They are: First, the well-known "Crowbar" case, reported by Harlow.[3] The subject, a young man in robust health, was wounded September 18, 1848, by the premature explosion of a blast. A tamping-iron, 3 feet 7 inches in length, 1¼ inch in diameter, and weighing

[1] Lesions du Cent. Ovale, Paris, 1877. [2] Lancet, 1900, vol. ii. p. 1432.
[3] Publications of Massachusetts Medical Society, 1868, vol. ii. p. 321.

13½ pounds, was driven quite through his head, entering through the left superior maxilla and emerging in the median line through the left frontal bone, just below the coronal suture. He was able to speak a few moments later, was carried for some distance in a sitting position with slight assistance, and was then able to walk up stairs. He was at first rational, but two days later became delirious with lucid intervals, and for the week following was again in normal mental condition.

The sight of the left eye was lost. Hernia cerebri formed, and beneath it an abscess which, when opened by excision of the cerebral extrusion, discharged about eight ounces of pus.

His mental condition as noted from time to time was thus set down.

*October 6th* (he was injured September 18th). "Appears demented or in a state of mental hebetude."

*15th.* "Intellectual manifestations feeble; exceedingly childish and capricious, but with a will as indomitable as ever."

*20th.* "Mind clearer, but still very childish."

*April*, 1849. "Left ptosis; can only depress and abduct the globus oculi; no other muscular impairment, physical health good; applied for employment, but his employers considered the change in his mind so marked that they could not give him his place again. He is fitful, irreverent, indulging at times in the grossest profanity (which was not previously his custom), manifesting but little deference for his fellows, impatient of restraint or advice, at times pertinaciously obstinate, yet capricious and vacillating, devising many plans of future operation which are no sooner arranged than abandoned in turn for others. A child in his intellectual manifestations, he has the animal passions of a strong man. Previous to this injury he possessed a well-balanced mind, which was radically changed."

In 1860 he had a long illness, "fell suddenly in a fit while at dinner," and fits continued till his death, May 21, 1861, twelve years and more after his injury was received.

No post-mortem examination was made, but the skull was afterward exhumed. From data afforded by Dr. Harlow's examination of the skull, and from an examination of the patient made by Dr. Bigelow two years after the accident, Ferrier was enabled to determine that "the whole lesion was situated anterior to the coronal suture and to the left of the median line. The iron comminuted and carried away the entire left lesser wing and one-half the greater wing of the sphenoid bone, and a large portion of the left orbital plate. No doubt the whole (cerebral) track is included within that region of the brain which I have described as the prefrontal. The only other region which the bar could have injured is the tip of the temporal lobe and the outer root of the olfactory bulb."

Second: A case reported to the Italian Psychiatrical Society, October 18, 1896, by Obici and Tambroni.[1]

Symptoms: Mental enfeeblement, characterized by loss of power of abstract connection, default in the power of psychical orientation, irritability; enfeeblement of character and of altruistic sentiment; tendency to suicide.

Seven months after commencement of the disease convulsions and paresis became manifest, and apoplexy supervened.

*Necropsy.* "Glioma occupying a large part of the left prefrontal lobe; no excess of ventricular fluid; no intracranial pressure."

Three generalizations were made from an analysis of my first series of cases. Some slight changes in the first of which, due to added experience or in the way of explanation, are necessary.

1. In every instance but two in which consciousness was retained or regained and the mental faculties were not perverted by general delirium, laceration involving the left frontal lobe was attended by default of intellectual control, and the lesion was usually, if not always, of the prefrontal region and implicated either its superior or inferior surface. Subcortical disintegration, or deep or extensive laceration of the cortex, was specially characterized by abrogation of mental power, and superficial laceration by aberration in its manifestations.

In one of the two exceptional instances referred to, in which laceration of the left frontal lobes was not attended by default of intellectual control, the supervention of final coma within two hours was so nearly immediate as to practically withdraw it from the class of cases under consideration.

The other case seems to have been made exceptional by reason of the mental condition having been regarded as normal on the one day only in which the patient emerged from a general condition of stupor.

In the first series of cases the inferior surface of the lobe was the more frequently implicated, but in the second it was the superior; and the abrogation of mental power seemed to be proportionate to the extent of the lesion rather than to its situation in the prefrontal region. The original proposition has been modified therefore in regard to these points. The other propositions remain unchanged.

2. In every instance in which laceration was confined to the right lobe the mental faculties were unaffected, except as they were obscured by stupor or delirium occasioned by coincident general lesion.

3. Compression or contusion of the left lobe only exceptionally produced specific intellectual disturbance.

This generalization is based upon an examination of an entire series of 295 cases in which the history was supplemented by necropsy.

[1] British Journal of Mental Science, 1897, p. 399.

It may be questioned, however, whether in recovering cases the lesion may not often be contusion, either limited to, or especially pronounced in, the left frontal lobe. This was undoubtedly the fact in Case I., and is not improbable in recovering cases in which delusions and other mental disturbances replace stupor, apathy, or other indications of simple mental decadence.

The large number of cases cited, with the analysis of their symptoms and lesions, are probably sufficient in themselves to form a basis for conclusions. They represent the personal observation and record of 800 cases of intracranial traumatism of which more than 300 were subjected to either operative or post-mortem inspection. Excluding those cases in which death had been preceded by primary and permanent unconsciousness, they were all germane to the present inquiry as showing either the presence of left frontal lesion where mental symptoms had been noted, or the absence of such symptoms where the lesion was situated in any other region of the brain. In many excluded, because unverified, cases, the coincidence of predominating symptoms of a mental disorder, with external indications pointing to a left frontal lesion, afforded at least a corroboration of the inferences which the post-mortem examination of the other cases proved to be well founded.

There are a still larger number of cases, unverified by necropsy, and therefore debarred in evidence, which are scarcely less convincing than those in which the essential condition of proof is obtainable. A number of such cases were included in the series of condensed histories appended to my work on *Brain Injuries*, to which reference has been made. Some well-marked instances were those numbered: CCXXXVI.; CCXXXIX.; CCXL.; CCXLI.; CCXLV.; CCXLVIII.; CCXLIX.; CCLIV.; CCLXXII.; CCLXXVIII.; CCLXXXII.; CCLXXXIII.; CCLXXXIV.; CCXC.; CCXCI.; CCC. The recovering cases, in fact, often present the most characteristic symptoms. In fatal cases the immediate effects of the concurrent general contusion may continue in some degree to the end, and during their continuance it may be difficult if not impossible to clearly recognize the evidences of the distinctive frontal lesion. If the cerebral circulation becomes readjusted and the impairment of consciousness or the delirium which the general vascular disturbance has occasioned passes away, there is no longer difficulty in referring stupor, apathy, delusions, or other indications of mental disorder or default to the lesion of specific centres of control to which it is properly attributable. It is to be noted that mental aberration no less than mental default is the result of lack of control, such symptoms "indicating activity on the lower level of evolution" (Jackson) and its inhibition on the higher level.

# BRAIN ABSCESS IN TYPHOID FEVER DUE TO BACILLUS TYPHOSUS.

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Definite infectious lesions of the brain or of its membranes would seem to belong to the more rare complications of typhoid fever. In his careful review of the literature up to 1898, W. W. Keen[1] mentions fifteen cases of meningitis and four of abscess of the brain as complications of typhoid fever or as sequelæ of the disease. In the cases of meningitis the bacillus typhosus was found in all cases, and in pure culture in twelve, while in none of the cases of abscess was any bacteriological examination made. In an extended search through the subsequent literature I have found reports of but five similar cases definitely established by autopsy or otherwise, four of them being meningitis and one brain abscess. Troisier and Sicard[2] report a case in which a fibropurulent exudate was found at the base of the brain, containing the bacillus typhosus in pure culture, symptoms of meningitis having appeared four days before death. Jemma[3] reports a case of cerebro-spinal meningitis in which the exudate was drawn off by lumbar puncture, and found to contain bacillus typhosus, no mention being made of other organisms. Tarchetti[4] mentions a case of meningitis in which the infectious agent was found to be bacillus typhosus. Fisher[5] describes a fatal case of meningitis in typhoid, bacillus typhosus being found in the serous exudate. He does not state whether other organisms were present. Brown[6] reports a case of abscess of the brain in typhoid, with recovery after operation. The pus contained staphylococcus pyogenes aureus in pure culture. We have thus nineteen cases of meningitis, in all of which bacillus typhosus was present, in the great majority in pure culture; and five cases of brain abscess, in none of which it was found. Most of the severe cephalic symptoms which have been noticed in the course of the disease have been found to be due or attributed to thrombosis of one of the cerebral arteries, of which Osler[7] has recently described four cases and Debove[8] one. Such being the status of affairs, the following case will be of interest as the only instance of brain abscess in which bacillus typhosus has been found to be the etiological factor:

Miss M. B., aged forty-nine years; occupation, teacher. Attending physician, Dr. W. G. Willard. Physician called April 7, 1901. Patient states that this is the first illness in years. During the last weeks of the school term just closed she has felt unusual fatigue and malaise. In three days immediately preceding had some chilly sensa-

tions, fever, and headache. On examination, temperature was 103° F., pulse 90. The tongue was moist, with a moderately heavy, white coating. There was no abdominal tenderness or distention; no rose spots were present, nor had she had epistaxis.

April 2d, probably the eighth day of the disease, a few rose spots appeared on the abdomen and chest. On this day she was removed to the Presbyterian Hospital. The course of the disease during the record week was even and all symptoms moderate. The temperature ranged from 101° F., A. M., to 103.5° F. or 104° F., P. M. She had an annoying dry cough, and was occasionally nauseated after taking milk foods. The stools were normal. Urinalysis showed a trace of albumin, but no casts. Diazo reaction questionable. During the third week the temperature ranged from 100° F., A. M., to 103° F., P. M. Her main complaint was of nausea and eructations, especially when milk foods were given. At the beginning of this week the agglutination test gave a probable positive result. Urinalysis showed a normal specific gravity, with absence of albumin and casts. During the fourth week the temperature ranged from 98.6° F., A. M., to 103.4°F., P. M.; pulse, 90 to 100. Toward the end of this week she complained of nervousness, and had a great dread of being left without an attendant, even for a moment.

The fifth week showed a temperature markedly remittent and sometimes intermittent, ranging from 98.4° F., A. M., to 101.4° F., P. M.; pulse, 84 to 94. Patient was still nervous, and toward the end of this week for the first time complained of slight ache on the back of the head. The following day she had some neuralgic pains on the left side of the head and neck. Sleep was fairly good. May 6th, the thirty-third day of the disease, temperature, 98.4° F.; pulse, 92. At noon she slept. On awakening seemed lost and talked incoherently; was nauseated and vomited after taking liquid nourishment; pale, and skin cold. At 2.30 P. M., a convulsion, epileptiform in character. Morphine, ¼ grain, given by order of house physician. At 3.20 P. M., a second convulsion, and shortly before 4 P. M., a third; the clonic spasms lasting five minutes. These were not completely unilateral, but very much more marked on the right side than on the left. The pupils were equally contracted; the tip of the tongue slightly abraded. At 4 P. M. the pulse was 152 and very weak; temperature, 101.2° F. At this time a thorough physical examination was made, with mainly negative results; no inequality of pupils, no paralysis; no sign of middle-ear disease; no phlebitis. There was at this time a marked mitral blowing systolic murmur, which had not been present previously, and which disappeared in twenty-four hours, as soon as the heart regained its tone.

By evening she seemed to understand what was said to her, but her speech was disconnected. At 8 P. M. temperature was 99° F. (rectal); pulse, 124. Urinalysis showed considerable albumin and numerous hyaline and granular casts. These disappeared in a few days. During the week immediately succeeding the convulsions the temperature ranged from 98.6° F., A. M., to 100.5° F., P.M. The mind, though clearer, was still much confused; and at times she complained of frontal headache, which was relieved by the ice-bag, which had been employed most of the time since the convulsions. At this time—end of the sixth week—there was marked amnesic aphasia; ice-cream was termed cotton-batting, and her nurses were called seamstresses, etc.

During the seventh week the temperature did not rise above 99.8° F. The pulse varied from 86 to 100. Sleep at night was good, and the urine was free from albumin and casts. In the earlier part of this week the patient had frequent headaches, and once told the nurse that she felt a twitching on the right side of the face; there was none visible, however. During the eighth week there was a slight evening elevation of temperature, 1°; much less headache; mental operations approaching normal; rarely at a loss for the right word; sleep sound at night. Early in the ninth week she again complained of severe headache in the forehead and vertex and back of the head. There was occasional retching.

On the night of June 1st, the fifty-ninth day, the patient slept well until 4 A. M., then awakened with pain in the back and the top of the head, nausea, and chilliness. Temperature was 99.6°F., pulse 100. At 7.30 A. M. temperature was 103.8° F., pulse 124; speech was incoherent. During the sixty-first and sixty-second days the symptoms were the same, but with a gradually deepening stupor; temperature 103° F., and Kernig's sign present.

Early in the sixty-third day—June 5th—the muscles of the right arm showed convulsive movements when the arm was held away from the body. Albumin and casts were again present in the urine. Temperature at 6 A. M. (rectal) was 104.8° F.; pulse 98; at 9 P. M., 105° F.; pulse 124. During the sixty-fourth day the temperature dropped until by evening it was 100° F.; pulse quite irregular; raised right hand to head. On the sixty-fifth day the temperature was normal at noon. Patient comprehended questions and answered intelligently; took liquid nourishment; at times raised hands to head as if in pain. On the sixty-sixth day—June 8th—tendency to slight spasm returned; patient was much weaker. Temperature at 6 A. M., 97.6 F°.; pulse, 132. Tendency to spasm continued throughout forenoon; pupils equal; patient steadily growing weaker; died at noon.

*Autopsy* (June 8th, 3 P. M.—Dr. Crowder). *Anatomical diagnosis.* Suppurative basilar meningitis; abscess of the left temporal lobe; purulent exudate in lateral ventricles; healing typhoid ulcers in ileum; acute splenic tumor; cloudy swelling of solid viscera; moderate diffuse arterio-sclerosis; chronic interstitial nephritis; healed tuberculous nodule of left upper lobe; misplacement of uterus; fibroids of uterus; catarrhal appendicitis.

The body is that of a well-developed, fairly well-nourished woman. It is still slightly warm. There is slight rigor mortis and posterior lividity. Beneath the clavicles and above the right breast are subcutaneous ecchymoses, about the locations of punctures made by hypodermics. The abdomen is distended and tympanitic.

The intestinal coils are distended with gas, particularly the cæcum and ascending colon. The peritoneum is smooth and shiny. The abdominal cavity contains a slight amount of clear, straw-colored fluid. The foramen of Winslow is patent. There are a few adhesions along the posterior border of the spleen. The vermiform appendix is free and has a mesentery throughout its whole extent. Its superficial vessels are greatly congested.

The pleural cavities are empty and free from adhesions. The pericardial cavity contains about two ounces of a clear, straw-colored fluid. The layers of the pericardium are smooth and shining.

The left lung presents a smooth pleura throughout, and is of a pale gray color; the upper lobe is spongy and the lower soggy. Over the posterior surface of the lung, covering about two-thirds of this surface, and of a dark bluish color, is an area slightly depressed below the surrounding tissue. The lung crepitates faintly. On section the lung is grayish-pink, the dark reddish-blue area extending in for 3 to 4 mm., and a moderate amount of blood and frothy serum exudes on pressure. A small puckered scar at the middle of the anterior surface of the upper lobe covers a calcareous nodule the size of a split pea. There is a slight thickening of the pleura at the apex. Except for the calcareous nodule, the right lung corresponds in every way with the left.

The heart weighs 260 gms., and its surface is smooth and shiny. The left ventricle is in contraction; the right contains a large amount of fluid blood. The endocardium and valves are normal throughout, excepting the anterior mitral curtain, which shows slight diffuse thickening, with three circumscribed, yellowish, opaque areas, which present a smooth surface and are not visibly elevated. The myocardium is firm, its texture fine, and its color a reddish-gray, with gray areas of fibrosis toward the tips of the papillary muscles of the left side.

The pulmonary artery is normal. The thoracic and abdominal aorta, and the beginnings of the coronary arteries, show small, diffuse, slightly elevated areas of sclerosis, presenting a slightly roughened surface.

The spleen weighs 300 gms. The lower extremity shows a cylindrical process marked off from the body by a deep notch in front, and a groove extending most of the way around. It presents torn adhesions along the posterior border, but is otherwise smooth, and of a slaty-blue color. It wrinkles easily, and is soft and elastic. It cuts readily. The pulp is of a dark reddish-brown color; the Malpighian corpuscles are only partially visible; the connective tissue is not visibly increased.

The liver weighs 1650 gms. Its external surface is smooth and paler than normal. It cuts with normal resistance. The cut surface has a grayish color and an opaque, boiled appearance. The lobular markings are faintly visible. The liver substance for a few millimetres, just under the capsule of the upper surface of the right lobe, is quite distinctly yellow. The gall-bladder is normal.

The pancreas is normal.

The stomach contains a quantity of partially digested food; its mucous membrane is smooth and thrown into folds, which are removed by stretching, and is covered by a layer of tenacious mucus. Toward the cardiac extremity there are a few very small submucous ecchymoses.

In the small intestine, two inches above the cæcum, is a large Peyer's patch showing a distinct diffuse pigmentation, and presenting at its centre an ulcer 3 cm. in diameter superficially, apparently in a healing condition. Approximately two feet from the cæcal end of the ileum is another Peyer's patch showing three areas of smaller diameter, which are apparently the seats of very superficial healing ulcers. The intestines show no other gross lesions.

The vermiform appendix is 9 cm. long; it is congested in its distal extremity, and rather firm. Its lumen is obliterated for the last 2 cm., and contains a small amount of viscid material.

The suprarenals are normal.

The left kidney weighs 160 gms.; the right, 155 gms. The external

surface of the left kidney is smooth, and it cuts with normal resistance. The capsule strips reluctantly, tearing the parenchyma with it in all places, and leaving a finely granular surface. The cortico-medullary relation is about one to three. The cortical markings are very distinct, and the cortex is pale in color; the glomeruli are visible as pin-point dots. The right kidney corresponds in every way to the left.

The body of the cervix lies horizontally, extending to the left of the median line, the body of the uterus forming a sharp angle forward and to the right. The anterior and posterior surfaces of the uterus show each one pea-sized subperitoneal fibroid. The cervical and vaginal mucosæ are normal; the hymen is intact. The urinary bladder is contracted, empty, and free from changes.

The scalp and skull are normal. The dura is adherent to the skull in the parieto-frontal region. There are no changes over the convexity of the brain. The base of the brain from the optic commissure backward over the pons, medulla, and cerebellum is covered with a thick, yellow, purulent exudate; and beneath the dura there is a considerable quantity of turbid, yellowish, serous fluid. The left temporal lobe is much larger in its posterior part than the right, and presents distinct evidence of fluctuation throughout most of the lobe. The exudate entirely surrounds the peduncles, and is found on the upper surface of the cerebellum. The ventricles are filled with turbid, brownish-yellow fluid, and the choroid plexus covered by exudate similar in appearance to that found at the base of the brain externally. A large cavity is found in the basilar part of the left temporal lobe, containing a bloody, thick, purulent material. There are no signs of middle-ear disease.

*Histological Examination.* The alveoli of the lung are slightly collapsed, and contain a few polymorphonuclear leucocytes, erythrocytes, and round cells; the bronchi are normal; the vessels are highly congested; the pleura is slightly hyperplastic.

The myocardium shows segmentation and some fragmentation, with considerable connective tissue among the muscle cells.

The spleen shows indistinct Malpighian corpuscles; there is intense congestion, with a great increase in the proportion of erythrocytes; the connective tissue shows slight hyperplasia, especially in the walls of the bloodvessels.

The liver contains numerous areas of focal necrosis; there are marked fatty change and moderate congestion.

The appendix shows a large number of leucocytic cells in the mucosa and submucosa, and a congestion of the vessels of the submucous and muscular coats.

The kidney shows capsules of the glomeruli to be thickened. The protoplasm of the tubular cells is often fragmented and the nuclei unstained; the tubules show many casts. The vessels are highly congested, and their walls show hyperplasia of the connective tissue.

The wall of the cerebral abscess shows a definite thin capsule of new connective tissue. Inside of this is a thick exudate, composed principally of polymorphonuclear leucocytes, with a few round cells, some red blood cells, and much necrotic material. Just outside of the capsule is an area of round-cell proliferation, containing small and large round cells and plasma cells, many showing karyokinetic figures. The surrounding brain substance shows some chromatolysis and some granular disintegration of the neuroglia. Paraffin sections stained by

Loeffler's methylene blue show groups of short, blunt bacilli with rounded ends, on both inside and outside of the capsule. Sections stained by Gram show no organisms.

*Bacteriological Examination.* Smears from the lung show a coccus which stains by Gram; from the liver and spleen a short bacillus destained by Gram; from the kidney and heart's blood no organisms. Plates from the lung contain a few yellowish, granular colonies of staphylococci, which retain Gram's stain and produce good yellowish or lemon-colored growths on agar and potato; some acid, without coagulation, in four days' milk, and liquefaction of gelatin in four days; diagnosed staphylococcus pyogenes aureus. Plates from the liver and spleen contain a fair number of colonies of bacillus coli communis and a few of an organism similar to that found in the cerebral lesions. Plates from the heart's blood and kidney show no growth.

During the autopsy, blood-serum and agar tubes were inoculated, with strict precautions, from the cerebellar exudate and from the cerebral abscess before it was opened. Smears from both show only a short bacillus with rounded ends, which destains by Gram, present in large numbers. Five inoculations on blood-serum—three from the cerebral abscess and two from the cerebellar exudate—and ten glycerin-agar plates from each, show in every instance pure cultures of a short, blunt, highly motile bacillus, with rounded ends, which destains by Gram. The morphology is entirely similar to that of bacillus typhosus. Stained by Loeffler's tannic acid method, the bacillus shows from ten to sixteen fairly long, wavy flagella, which have a peritrichal arrangement. The cultural appearances on ordinary laboratory media indicated the advisability of inoculations on differential media, which were made as follows:

*Hiss' Agar-gelatin.* (*a*) Agar, 5 gms.; gelatin, 80 gms.; beef extract, 5 gms.; NaCl, 5 gms.; glucose, 10 gms.; distilled water, 100 c.c.; titrated to 1.5 per cent. acid (phenolphthalein). Inoculations made in tubes containing about two inches of medium, by placing on the surface a small drop of a bouillon culture. At eighteen hours (37° C.) the upper inch of the medium is uniformly clouded, with small projections of growth into the unclouded portion. At thirty-six hours the whole of the tube is uniformly clouded; no gas is apparent. A similar inoculation with a stock bacillus coli communis produces in forty-eight hours (37° C.) a stronger clouding of the medium for the upper one-fourth of the tube with small gas-bubbles. (*b*) Agar, 10 gms.; gelatin, 25 gms.; meat extract, 5 gms.; NaCl, 5 gms.; glucose, 10 gms.; distilled water, 1000 c.c.; titrated to 2 per cent. acid (phenolphthalein). In plates inoculated from glycerin-agar cultures, thirty-six hours at 37° C., deep colonies are very small, spherical, or slightly ovoid, clear, and transparent, showing under the microscope many short, thread-like, wavy projections, which sometimes seem to be separated from the colony. Surface colonies are small, circular, and clear; microscopically show a yellowish nucleus, with a very thin transparent periphery, often prolonged into thread-like processes, extending out and down into the medium.

*Laboratory Stock Gelatin.* Growth in stab inoculations at 22° C. is slow. At seventy-two hours a thin white growth is visible along the stab; delicate, not continuous; no gas. There is very little change in thirty days. Similar inoculations of hog cholera show at seventy-

two hours a vigorous continuous growth; of bacillus coli a strong growth and gas formation.

*Elsner's KI Potato-agar.* Potato, 500 gm.; distilled water, 1000 c.c.; boiled one-half hour; filtered; gelatin, 100 gm., added; neutralized by NaOH; filtered; sterilized; 1 per cent. KI added; sterilized. Inoculated from glycerin-agar culture and plated. At twenty-four hours (37° C.) no growth is apparent. At thirty-six hours 3 colonies are visible to the naked eye; at forty-eight hours, 12; at seventy-two hours, 41. They appear as minute, shining, clear points. Under the microscope the deep colonies are very small, slightly brownish, homogeneous, with finely beaded edges. The superficial colonies show only an intimation of a nucleus; they are almost transparent throughout, homogeneous, very finely granular, with distinct, regular edges.

*Sugar-free Bouillon.* Chopped beef-heart infused in distilled water at 60° C. one-half hour. Filtered; inoculated with bacillus coli; incubated twelve hours; sterilized; filtered; peptone, 10 gm., NaCl, 5 gm., added to 1000 c.c.; neutralized (litmus); filtered; sterilized. Twelve tubes inoculated from glycerin-agar examined at intervals of two days for indol show no indol production, except tube 8, at sixteen days, which shows a possible trace. Comparative inoculation with bacillus coli shows positive indol production at thirty-six hours.

*Arsenious Acid Bouillon.* Sugar-free bouillon, with (*a*) 0.005 per cent., (*b*) 0.01 per cent., (*c*) 0.02 per cent. arsenious acid added. Inoculation from glycerin-agar in (*a*) shows no growth in seventy-two hours at 37° C. to the naked eye; but, microscopically, some multiplication is apparent. Both *b* and *c* show no growth at all in six days. Bacillus coli grows fairly well in *c*.

*Dextrose Bouillon.* Sugar-free bouillon, with 1 per cent. dextrose added. Inoculations from glycerin-agar in fermentation tubes show no gas production in six days. In test-tubes 3.2 per cent. acid is formed in six days as shown by titration to neutral (phenolphthalein), with tenth standard NaOH. In the same medium the bacillus of hog-cholera produces a bubble of gas and 3.4 per cent. acid in six days.

*Lactose Bouillon.* Sugar-free bouillon, with 1 per cent. lactose added. Inoculation from glycerin-agar produces no gas in six days in fermentation tubes. In test-tubes 0.3 per cent. alkalinity is produced in six days, as shown by titration to neutral (phenolphthalein) by oxalic acid and NaOH. The bacillus of hog-cholera produces under the same circumstances no gas and 1.1 per cent. alkalinity.

*Sucrose Bouillon.* Sugar-free bouillon, with 1 per cent. sucrose added. Inoculation from glycerin-agar in fermentation tubes produce no gas in six days; in test-tubes 2.6 per cent. alkalinity in six days. The bacillus of hog-cholera produces no gas and 2.9 per cent. alkalinity in six days in the same medium.

*Laboratory Stock Litmus Milk.* Inoculation from glycerin-agar produces no discoloration on the fourth day. In four weeks there is an intensification of the blue color. The milk is not coagulated.

*Petruschky's Litmus Milk Whey.* Milk clotted by rennet and strained; whey neutralized with citric acid (litmus); heated at 100° C. one-half hour; filtered; neutral litmus added; sterilized. Inoculation from glycerin-agar produces in twenty-four hours at 37° C. a very slight cloudiness and acid reaction of 1.8 per cent.; at forty-eight hours a slight cloudiness and acid reaction of 2.4 per cent.; at seventy-

two hours acid reaction of 2.6 per cent.; no further change at ten days. In the same medium bacillus coli produces in forty-eight hours marked cloudiness and 9.8 per cent. acid.

*Capaldi-Proskauer* (9), *Media I. and II.* Inoculation from glycerin-agar in I. shows no growth; in II. shows slight cloudiness and 1.2 per cent. acid in forty-eight hours at 37° C.; alkaline on the sixth day. In I. bacillus coli produces some cloudiness in forty-eight hours; in II. marked cloudiness and 3.7 per cent. acid in forty-eight hours, remaining acid at ten days.

*Laboratory Stock Glycerin-Agar.* The surface of solidified plates is inoculated with a spatula over an area one-half by two inches with (*a*) laboratory stock typhoid, (*b*) hog-cholera, (*c*) bacillus coli. The plates are then incubated for seventy-two hours at 37° C., and the resulting growth carefully scraped off. The plates are then re-incubated for twenty-four hours at 37° C. to insure no further growth. Streak inoculations from glycerin-agar on *a*, one through the middle of the scraped area and another on fresh medium at one side produce a good growth on the fresh area and no growth at all over the scraped area. Similar inoculations on *b* and *c* produce growths along all streaks, those over the scraped areas in each case being less vigorous than the parallel side streaks on fresh medium, plates in each case being incubated forty-eight hours at 37° C. On plates similarly prepared with the bacillus under discussion, and inoculated similarly in streaks with (*a*) stock typhoid, (*b*) hog-cholera, and (*c*) bacillus coli, *a* produces a good growth on the fresh medium and no growth at all on the scraped area; *b* and *c* grow on both, though not so well on the scraped area as on the fresh medium.

*Agglutination Experiments.* Positive agglutination of the bacillus is obtained with blood from the liver and spleen of the patient, dried on blotting paper at dilution (estimated) of 1 to 50. With a serum from a severe case of typhoid fever, having an agglutinative power of 1 to 1000 on stock hospital bacillus typhosus, a positive reaction is obtained in dilution of 1 to 500. Agglutination is regarded as complete when large clumps of bacilli are produced, with practical cessation of motility and clearing of the field of single organisms, bacilli from twenty-four hour glycerin-agar cultures suspended in distilled water being used for tests.

Intraperitoneal injection of a forty-eight hour culture on glycerin-agar in distilled water in a guinea-pig causes evident illness, with weakness and loss of appetite. Temperature after thirty-six hours, 105.5° F.; after three days, 104.8° F.; after four days, 104.2° F.; animal apparently well.

Serum from this guinea-pig before inoculation gave no agglutination reaction with stock cultures of bacillus typhosus, hog-cholera, nor the organism under discussion. After receiving, on each second day for thirty days, intraperitoneal injections of increasing quantities of live bacilli in distilled water—the last dose being the forty-eight hour growth from ten glycerin-agar tubes—the pig's serum gives a positive reaction with this bacillus in a dilution of 1 to 10,000. With four races of typhoid bacilli from different hospital stock cultures this same serum gives a positive reaction in dilutions of 1 to 4000, 1 to 1000, 1 to 2000, and 1 to 400, respectively. With the hog-cholera bacillus a reaction occurs at 1 to 50, which is suggestive at two hours. On bacillus coli the serum has no effect whatever.

There can be no question that we have here to do with an abscess of the brain caused by a true bacillus typhosus. The organism is differentiated from the colon group by all cultural appearances and reactions, and from the Gaertner group by its growth on gelatin and in the sugar and milk media, as well as by the results of agglutination experiments. The characteristic growths of the other organisms of the genus on the same media is sufficient guarantee of the correctness of conclusions drawn from the cultural appearances, and the agglutination results are as definite as could be wished, if we bear in mind the inconstancy of the effects of so-called "specific sera" on their own and nearly allied races.

I wish to express my gratitude to my teacher, Dr. Hektoen, for his many suggestions and helps in the course of the bacteriological examination, and to Dr. W. G. Willard, of Chicago, for the clinical history.

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## MODERN MASTOID TREPHINING OPERATIONS,

### WITH NOTES ON ONE HUNDRED RECENT OPERATIONS.

By B. Alexander Randall, M.A., M.D.,
of Philadelphia.

Mastoid trephining is a term growing less common, both because the crown-trephine has almost wholly passed out of use in this field and because increasing elaboration and differentiation have substituted special names to indicate the varying purpose and technique of the intervention. Too often these specialized procedures, as in other surgical lines, have been veiled behind personal names which, even to the specialist, convey hazy if not erroneous ideas as to their nature; and, while the best otological text-books generally present the complex matter fairly, the same can rarely be said of the current papers in the journals. The specialists in each surgical field are apt to write for special audiences at medical meetings, are prone to use technicalities and personal names that convey little to the general reader, and their writings are generally given to the special journals both by choice of

the writer and through the indifference of the other editors. Yet it is of great moment that the general practitioners, who must render first aid in the majority of ear diseases, should have clearer and sometimes fuller information in these lines, not only that they may better advise their cases, but also that in the numerous instances where the operative intervention must be carried out with no help from the especially trained colleague, they may do so unburdened by the many exploded teachings which still occupy the surgical works or by the too specialized descriptions of otological literature.

Even the fundamental facts in this field of practice have not yet been clearly grasped by many otological practitioners; their anatomical knowledge is still encumbered by old misunderstandings, and the semi-isolation of the specialist has at times led him to rest too much upon his individual experience, which may have been both narrow and wholly exceptional. Some have urged that operation should never be needed, since they have met no cases which, to them, presented indications clearly demanding it; others have seen in hospitals such series of cases, already past all chance of resolution, that they feel that non-operative measures are generally inefficient and signs of culpable timidity. Dispensary practice, in spite of its wealth of opportunity, is far less deeply instructive than the close acquaintance and control of patients possible in private practice, especially in the more isolated communities, and may beget superficial views and needlessly radical tendencies to prompt operation; and the material is so different, and the personal tendencies and class tendencies both in habits and pathology vary so utterly, that our ideas must be broad to the limit of definiteness if they are to embrace any majority of our experiences. Some elementary considerations, therefore, seem called for.

Almost all demands for the interventions under discussion arise from infective, purulent catarrh of the middle ear. This middle ear is not an unknowable field beyond the ken of the general practitioner; less still a tiny field of which the tympanic membrane, often miscalled the drum, is the major part. It is a varyingly complex mucous tract extending out and back from the nasopharynx, where it begins as the Eustachian tube mouth visible in the rhinoscopical mirror, and it comprises the tube, tympanum, and pneumatic cells—the last most conspicuous in and about the mastoid process, but by no means confined to it, since they frequently pervade the whole temporal bone from zygoma to sella turcica, and may invade the adjacent occipital bone behind and below. The auditory canal, with the drumhead at its bottom (Fig. 1), gives us access to the middle of the tract—its strategical key, as we may say—since here the battle to save the hearing and to forestall the numerous malign possibilities can be most promptly, readily, and successfully fought. The conducting apparatus of drumhead and ossicles here

located is easily damaged, and then becomes a hinderance instead of an aid to hearing; and while experience has exploded most of the claims as to any great relief of deafness by their removal, it has justified this measure when they seem obstructive in the suppurative conditions. The tympanum or drum-cavity comprises the antrum and the attic spaces, as well as the lower cavity just within the drumhead ("atrium"—Leidy). Those less obvious upper portions, which are with difficulty seen or reached from the canal, have great pathological importance, since no direct drainage by way of the Eustachian tube is possible to them; nor, when it fails, is there a yielding membrane to give, in a safe direction, easy exit to pent-up secretion. The tympanic attic is sub-

FIG. 1.

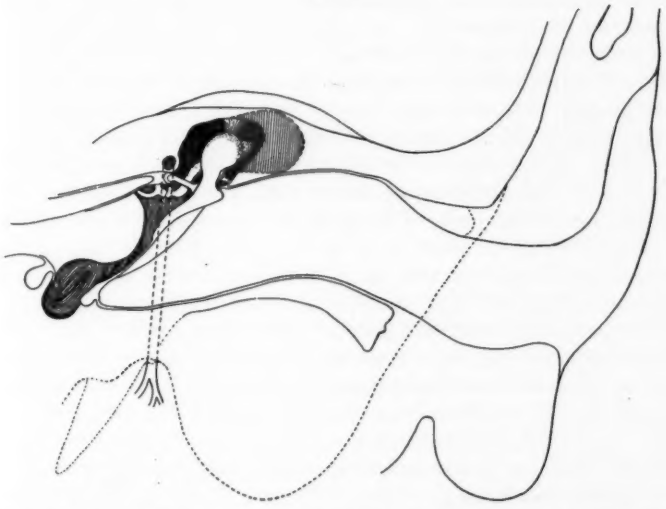


Diagram of canal and tympanum, showing the relation of the attic and shaded antrum to the canal and the mastoid process, and the course of the facial nerve above the stapes and downward to the stylomastoid exit.

divided by the ossicles and their ligaments, and can generally drain through the lower cavity, from which it is separated only partially by soft-tissue septa; but the antrum has only its limited opening into the attic, which may be so obstructed that any septic contents can pass with least resistance into the mastoid cells and involve them in its suppuration. Bearing in mind that all these cavities are lined by delicate mucoperiosteum, we realize that mere superficial ulceration may destroy the vitality of the underlying bone, even if this has failed to become itself infected. Hence the rapidity with which extensive temporal caries may follow nasopharyngeal suppuration ceases to be any marvel.

But the antrum is not an isolated structure—the thin tegmen covering it and the attic connects rather than separates its lining and the dura mater of the middle cerebral fossa; its posterior wall is almost as thin toward the sigmoid sinus; the bony canals of the facial nerve and horizontal semicircular canal form its inner wall, and the bulb of the jugular and other vessels are, in rare cases, in close proximity, and in all cases receive its emissaries—so its septic involvement readily gives rise to life-imperilling processes. Outward, its walls may be dense and impervious; not only preventing the forcing of an exit in this direction, but even shutting in almost every sign of the underlying inflammation.

Accepting the demonstrable fact that the tympanic antrum is involved in almost every suppuration, and is the centre of the carious process in most cases requiring intervention, it is evident that our trephining procedure, to be efficient, must succeed in draining it, and not rest content with having entered the cellular structure of the mastoid process. There are some cases, especially among those due to influenza, in which the empyema seems limited to the mastoid tip, full resolution having occurred in the tympanic cavities. In these rare instances it may suffice to open and drain the lower areas, without penetrating to the antrum; but, even of these, some will prove disappointing if more thorough work is not done. For the rest, antrum drainage is always requisite in the acute cases, while in the mastoid empyemas dependent upon chronic suppuration this must constitute but a part of a more radical measure. And in the large group of the chronic suppurations which resist all milder efforts to cure them, operation for exenteration of the tympanic cavities must be considered, even though no evidence of mastoid empyema or caries is recognizable, for experience shows that too large a number are maintained by caries or cholesteatoma, and sooner or later have extension of trouble which may then prove irremediable.

This distinction between the acute and the chronic suppurations is cardinal, yet it still lacks due general acceptance even among otologists. With the misleading histories so commonly given, we realize too late in some of our cases that we have done only the simpler antrum operation where we ought to have exenterated all the tympanic cavities. Great good may nevertheless be achieved in affording a temporary relief, under which the patient improves and the suppuration seems nearly cured; but a partial success is really a failure, and recurrence of local lesion and intracranial extension may yet follow the imperfect intervention, while the dashing of the patient's hopes may suffice to prevent his assent to later and more urgent operation. At best, other advice will often be sought, and all credit of benefit go to the second operation, while any mischance may be ascribed to the failure of the first. Infal-

libility will never be attained. The human organisms upon which we operate are too various, and are subject to ups and downs that must hugely influence results, and the highest skill in diagnosis and treatment cannot preclude some failures; yet some of these may be foreseen and forestalled under simple rules.

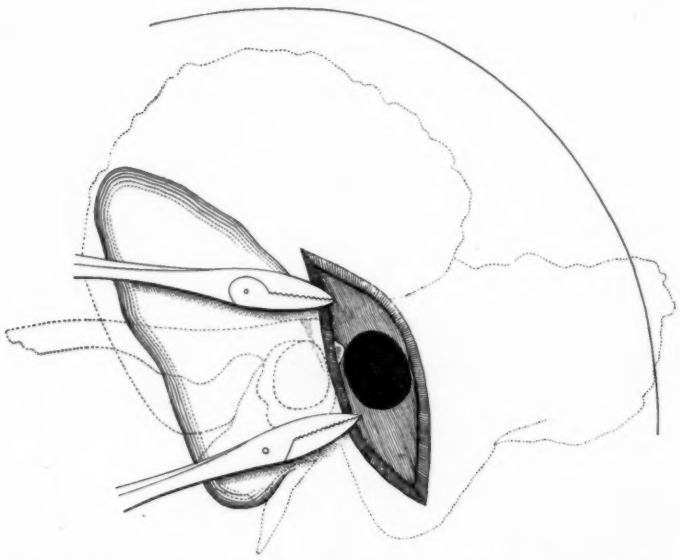
Space is lacking to go into full detail as to the indications for operation. When, in a suppurative catarrh of the tympanum, pain, tenderness on pressure, fever, swelling, and redness of the mastoid region persist beyond a week after free incision of the drumhead and adjacent wall, with complete rest in bed and vigorous use of hot, sterile douching in the canal and heat or cold to the mastoid, there ought to be little delay in opening to the antrum to seek and evacuate retained pus. Fever or rigors may be lacking, pain absent except at night, swelling and other local evidences hardly if at all recognizable, even on the upper back wall of the canal, and yet experienced surgeons will "feel" the need of exploratory operation. Undefinable as may be the indications, it is yet clear that delay is more dangerous than intervention. In the hands of a skilled surgeon operation should hardly more than double the scarce measurable dangers of etherization; and unless extensive lesion is found there should be practically no scarring, as to which we must pardon our patients for being at times more solicitous than as to deafness or even life-risk. For mere suppuration without disquieting symptoms we must as yet be very cautious in urging operation, and only after full effort has been made to improve the general and local health should we decide that tympanic exenteration is needful.

From the foregoing considerations much of our operative work readily shapes itself. In the acute empyemas of the mastoid we must drain the purulent area, which is almost always the antrum, with few or many of the adjacent cells. To this end we incise a little back of the insertion of the auricle, carrying the knife to the bone and from the tip of the mastoid process to the upper part of the helix, thus giving an ample wound of the soft tissues. The periosteum is then lifted (the gouge often makes the best raspatory), especially forward, until the back margin of the canal is reached, with its "spina suprameatum." (Fig. 2.) This thorn-like suprameatal spine, with a depression behind it, can be recognized with the finger in almost every case; is the only reliable element of any "post-meatal triangle," and furnishes our best landmark. Close behind this is the typical point for opening the bone. The floor of the middle cerebral fossa may be no higher than the spina, but can hardly be lower; the knee of the sigmoid sinus may come thus far forward, instead of lying the average ten millimetres back and up; the antrum may be but a millimetre within the cortex in an infant, or an inch away in the adult with a large mastoid; yet in general we can safely chisel inward, forward, and upward from a point close behind

the spina, and a depth of some fifteen to twenty millimetres should enter the antrum. Remembering that this cavity lies up and back from the canal, separated from it only by a wedge-shaped partition of bone, we have a constant guide to it furnished by a probe in the canal, the roof of which is about level with the floor of the antrum.

As there is no means of foretelling the relation of the lateral sinus to the operative field, it is essential to safe work that we employ, instead of any blindly-entering boring device, the chisel or spoon, which enable us to remove scale by scale of the bone without risk to the underlying

FIG. 2.



Mastoid incision and bone opening for simple antrum exenteration, to be extended in every direction required. The soft tissues are pressed forward to reveal the spina suprameatum. The region shaved within three inches from the canal.

structures. Further, it is needful to rest the thumb or the finger at the very edge of the chisel, so as to exercise full control. So working, whether by hand-power only or with the mallet to propel the chisel, the bone can be quickly cut away without risk to the sinus, if in the field, or of entering precipitately into a cavity such as we often find occupying the whole mastoid process. The old plan of entering on the convexity of the mastoid at about the position of the incision through the soft parts will frequently endanger the sinus, as this is the point where it commonly comes closest to the surface; and to use a gimlet, as some

even of the recent surgical works advise, is permissible only in dire emergency. Personally, I have come to prefer the spoon as devised by J. F. McKernon, with fenestrated cup, short shank, and pear-shaped handle (Fig. 3), the whole but twelve centimetres long, supplemented by a gouge ten millimetres broad, similarly mounted, and a strong but narrow-beaked rongeur, which can enter deeply into a narrow tract. (Fig. 4.) A flatter spoon is safer for removing the inner table for the free evacuation of extradural collections, and a narrow and more beaked spoon for exenterating the antrum or other tympanic cavities. (Fig. 5.) For the mallet I have no use, and regard its blows as deleterious.

When the mastoid empyema or caries is due to *chronic* tympanic suppuration, the antrum operation, however thorough (" antrectomy "—

FIG. 3.

McKernon's spoon, with straight-edged, fenestrated cup.

FIG. 4.

Back-curved, short-handled gouge.

FIG. 5.

Double-ended beaked spoon for antrum and attic.

M. Sheild), will generally prove inadequate. Not only must the antrum be drained and scraped out, and all septic or suspicious foci elsewhere similarly dealt with, but we must empty and render free for good future drainage all the tympanic cavities. This " radical operation," better defined as " tympano-mastoid exenteration," owes much to Kuester's " Cure of Suppuration in Rigid-walled Cavities," as well as to Stacke and other otologists. Its essence is that we throw attic, antrum, and lower tympanic cavity, together with all affected mastoid cells, into one with the deeper part of the canal by removing the septa which separate them, and then by plastic measures cover in promptly the walls of this large cavity with healthy epithelium. (Fig. 6.) Remembering that the upper back wall of the canal is formed by a wedge-shaped plate of the squama

("scute"—Leidy), we see that this, with the drum-membrane, malleus, and incus are to be removed, as well as so much of the back wall of the canal as is needful to give present and future access to the whole tract involved. Some operators work from within outward, most from without inward—I prefer to work in both directions; but in any case the soft tissues are to be shelled out of the external canal to give good access to its back wall.

The incision for this operation must be wider, passing above the auricle to or even through the temporal artery, and this or the previous incision can be enlarged by cutting backward. Its lower or mastoid portion may be a single cut to the bone, but the upper part is best carried only to the fascia and a flap of the superficial tissue turned down as far as the zygoma and its suprameatal ridge; then the periosteum

FIG. 6.

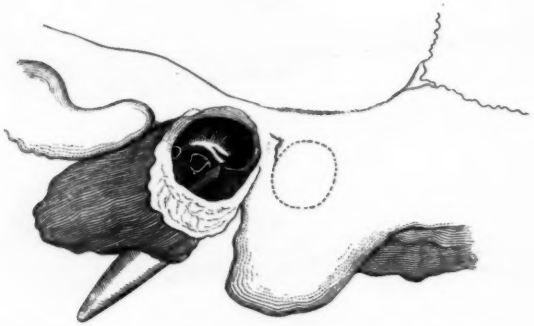


Diagram of tympanic exenteration, with removal of the outer wall of attic and antrum, uncovering the stapes, and above it the ridges of the facial and horizontal semicircular canals. The site of the usual mastoid opening (which some needlessly make as part of this operation) is dotted.

is cut below this line and detached forward and downward into the depths of the canal. Incision within the canal is needless if the gouge is used to shell out the soft tissues, for they rupture at their thinnest part, close to the drum-head, and can be readily turned forward out of the way; but all roughness and crushing is to be strenuously avoided, since these are the best tissues to preserve for our plastic work. With the bare temporal bone before us we can proceed according to the indications—exenterating the tympanum only, if this seems alone involved, or removing the entire mastoid and curetting open every adjacent cell which is even suspected of complicity. Those just within the digastric fossa are especially to be remembered, for they are often large and especially vulnerable. Nor must we in suspicious cases limit our work to the bony structures, for infection has often passed down or back along

the muscles and their fascial sheaths, following the great vessels of the neck or burrowing under the occiput, and any infected glands, especially in tubercular cases, should be thoroughly curetted.

In this exenteration of the tympanic cavities we can work from within outward, as advocated by Stacke, or from without inward, as urged by Kuester, or combine the methods, as done by Schwartze and others, the object being always to obtain quickly, safely, and thoroughly the elimination of the diseased foci. As an hour or more is often required to do the work thoroughly, all waste work is to be deprecated; so the opening of the healthy mastoid merely to introduce a "protector" in front of the facial nerve seems a clumsy procedure when the chiselling can be restricted to the affected region. By entering the upper back wall of the canal some ten millimetres exterior to the annulus, and working a notch with a shoulder past which the chisel will not slip, the attic and the antrum can be extensively opened before the tympanic margin is touched, a bridge of the bone being retained as a "protector" in front of the facial canal, and broken away by safe *outward* traction when it has been so thinned as no longer to be a safeguard. That this is all done at the bottom of the narrow though bare external canal, and is somewhat impeded by blood, is no reason for opening more bloodvessels, as in the Schwartze-Stacke operation; and only occasionally does it seem needful or advisable to chisel away the whole of the back wall of the canal merely to gain a little room.

When some cases unexpectedly reveal outward extension of the diseased process, and demand full mastoid exenteration, we may regret that we had not saved time by doing this curetting first; but as it can later be as safely and thoroughly done at small cost of time, this group furnishes no reason why we should subject the larger number to needless mutilation.

The combination of the two procedures above spoken of must be the rule for all cases of mastoid caries with chronic tympanic suppuration. A few of these would be cured by simple mastoid exenteration; but as it is impossible to foresee this, the "radical operation" is safer and more truly conservative. To call it "tympano-mastoid exenteration" leaves no doubt as to what is to be done, nor does it apparently bind the operator down to "trephining" or "chiselling" when he may prefer the curette. In many of these mastoids an old bone sinus will be already present, and the underlying large carious cavity is best opened fully by the rongeur. Work inward which is not fully guarded from undue penetration is especially dangerous, since the inner table of the mastoid is often extensively lost, and the sinus or other dural surfaces are open to easy injury. Indeed, the pachymeningitic thickening may be accompanied by so much softening or even ulceration that gentle use of the probe is not safe against penetration into the bloodvessels or

the brain. It is wiser wholly to avoid the dangerous directions until the work in other parts has been completed; then it will be easier to see exactly what remains to be done and to complete it with safety; or if hemorrhage compels us to desist, we will leave little undone. A shallow spoon can most safely be carried along any bare dura, cutting away outward the soft margins of the inner table and exposing any extradural abscess; yet even the smooth back of this spoon, if not gently used, may penetrate. Some authorities counsel against the removal of pachymeningitic granulations, believing them wholly protective; but individual decision must be made on this point, and as they are generally infected, the presumption is against the safety of leaving them uncuretted. Avoiding, then, all needless extension of the operation, yet conscientiously following to its end every unhealthy tract in bone

FIG. 7.

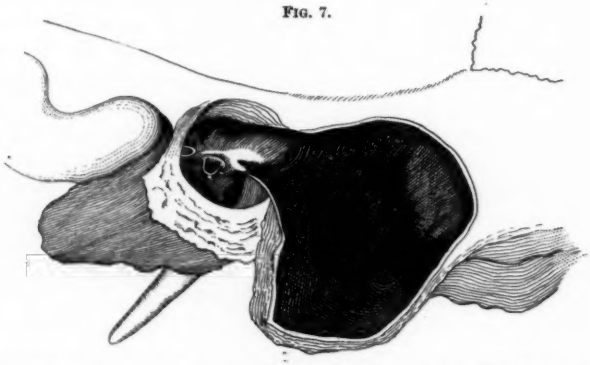


Diagram of tympano-mastoid exenteration, showing the empty cavities thrown into one with the auditory canal, the lower posterior wall of which forms a ridge protecting the course of the facial nerve in its descent to its exit.

or soft tissues, we remove the back wall of the canal, so as to throw into one cavity, without intercepting prominences, all of the affected cavities, gaining an open wound of which every part should remain accessible for the future. (Fig. 7.)

To this end the plastic idea advocated by Stacke and Kuester has given great aid. Instead of packing the extensive cavity more or less completely from behind, and maintaining such dressing for months until new tissues fill it, the prime effort is to inaugurate a skin covering of the cavity as a diverticulum of the external canal, draining, and open to ready access through the natural opening. The mastoid wound need not be maintained except in rare instances of inveterate cholesteatoma-formation, and these will generally declare themselves by refusing to heal, so the attempt at prime union can usually be made by complete but not very close suturing of the mastoid incision. The flaps by means of which the bare bone is covered are variously made, generally

from the soft tissues of the canal, supplemented perhaps by skin from the exterior of the mastoid, and secondarily by Thiersch grafts. One important principle has been too generally neglected: The cartilage of the canal is useless for grafts, melting down itself, and too often involving in its necrosis the better tissues. It should be exsected in forming the flaps, therefore, and in doing this the canal wall should be *split* into the periosteal and skin layers between which the cartilage lies. A square inch of tissue can thus be made to yield two flaps of this extent, one of which is generally turned up and the other downward, to cover as much as possible of the cavity wall. Some surgeons merely excise these soft tissues, so as to gain free opening through the back wall of the canal; some make flaps of the entire thickness, which are ill-fitted, by their thickness and by reason of the contained cartilage, satisfactorily to close this cavity, while their area is but half of that obtained by the method above described. The osteoplastic method of Kuester seems a wholly needless procedure, suggesting clumsiness of the surgeon rather than up-to-date resource. Packing is to be carried through the canal in all but the simple antrum operations (which may be allowed to close with blood-clot), so as to hold in place the plastic flaps—an adjustment best made before the posterior wound is closed, but after all the sutures have been placed.

Healing after the operation varies according to its extent and the vital powers of the patient, being attained in one to four weeks in the simple antrum exenterations, in three to six weeks in the tympanic interventions, while for the total covering of a large mastoid wound six to eight weeks is a safer allowance. But of this time little need generally be spent in confinement. Three to seven days in bed, with dressings as infrequent as pain, fever, discharge, and odor will permit, and as much longer detention in the house, usually suffices. Bandaging is needless after the first week in some and after the second week in all but a fraction of the cases; stitches are generally removed on the fifth or sixth day, and packing is rarely called for after the first week. Irrigation should be used if odor is present; and cleansing by way of the canal, with cauterization, by silver or chromic acid, of exuberant granulations is requisite in the later stages to prevent stenosis of the opening back into the antrum and mastoid.

Facial palsy will be caused in a few cases, rarely in careful hands, except when the caries already surrounds the nerve. For these it is fair to claim that it has been precipitated rather than caused, for the lesion would generally have spontaneously occurred, and all too often would have proved more persistent. The surgical paralysis is generally cured in from six to twelve weeks. If we avoid too tight packing, which may press injuriously upon it in the upper part of its course, and in removing the back wall of the canal go no lower than the middle

of the tympanic margin, we ought to run little risk. To watch the face for evidence of irritation of the facial should be merely an adjuvant to the more surgical plan of knowing where one is and what he is doing, with avoidance of the well-defined path of the nerve. This is exposed to injury from the geniculate ganglion just above the trochlea of the tensor tympani, throughout its backward course above the oval window and in its vertical portion from three millimetres back of the middle of the tympanic margin to its stylomastoid exit, but in my own hands has been almost never injured.

As to the hearing, the operation can be considered purely conservative, its early performance frequently saving hearing which might have been lost in the longer-continued inflammation; and the operation, by terminating the disease, generally gives the only reasonable chance for all possible retention of function. The removal of the drum-head and ossicles which constitute a part of the tympanic exenteration has proved of little value for the improvement of hearing, but simply conserves what has been left by the suppuration.

Among the mastoid operations of the past two years, numbering one hundred, forty-nine were the simple antrum operations, generally for acute lesions, thirty-nine were radical tympano-mastoid exenterations, and but twelve were done after Stacke's method of tympanic exenteration for chronic suppuration without mastoid caries. Two only of the acute mastoid empyemas—one scarlatinal and one grippal—occurred under my own care, unless we include a feeble old Hebrew who refused to come into the hospital, but attended irregularly at the out-clinic until long after operation was clearly unavoidable, yet who ought probably to have been saved from it by rest in bed. This does not imply that most of the others might have been saved by skilful treatment, but it does bear out my contention that vigorous hot douching and such methods cannot be so harmful as claimed by some authorities, since quite six hundred acute suppurations—nearly two hundred of them with mastoid tenderness, redness, and swelling—when first seen were so treated within these two years, and three at most are known to have gone on to mastoid caries. Where the suppurative process, having reached or passed its acme, has brought the bony tissues to the verge of destruction, theory as well as abundant experience convinces me that *heat* is our best aid in combating the danger. This can best be applied by the hot douche in the canal, which carries the heat to and even through the affected tissues, supplemented by dry heat alternating with mere protection over the mastoid. Warmth and moisture may be deleterious, but heat pushed to the limit of tolerance should have all the constringent effect claimed for cold, while more conservative of the vitality. More than one thousand mastoid inflammations which I have treated with heat have gone on to prompt resolution, with hardly a dozen instances of

failure to abort the empyema, while it so chances that almost every one of the few cases treated with ice have gone on to operation.

The mortality after mastoid operations varies largely through extraneous causes, few if any deaths being ever ascribable to the intervention. My list of eleven deaths in this hundred equals my whole previous loss in some three hundred operations, and includes three children dying of pneumonia and other unrelated conditions; two in whom fatal meningitis was present before operation and was unrelieved by removal of the primary focus of infection in the temporal bone, or in one case by exploratory opening and flushing of the meningeal cavities. Two succumbed to pyæmia from lateral sinus thrombosis, one to brain abscess which had been found and drained, and one to recurrent cerebral apoplexy. Early operation can do much to prevent the occurrence of these fatal complications, and even after they have arisen may snatch from the very jaws of death cases which must otherwise have speedily died. In this latter group may fairly be counted the cured cases of brain abscess, and several among some thirty marked extradural abscess cases, in three of which ulceration had already destroyed an area of the dura. Yet there are acute cases in which meningitis seems toxic rather than infective and may even antedate the mastoid involvement, just as many cases die without evidence of a drop of pus, still less caries, in any part of the ear. If the infected tract within the temporal bone be always followed to its end, with good drainage of the frequent extradural collections, and a conscientious penetration on into the meninges or into the brain when there is probability of involvement of these deeper parts, the death-list will be further reduced. Tubercular and other forms of leptomeningitis ought to yield nearly as good results to aseptic irrigation as have been obtained in the peritoneal cavity, if the mechanical difficulties of flushing, without dangerous pressure, the intracranial cavities can be overcome. To this end I believe an irrigation tube, with minute openings at its spatula tip, will serve a very good purpose, since it can be passed far under the brain and, lifting it away from the dura, permit of a good flushing even to the base.

Another point as to these intracranial explorations seems to demand a few words. Most writers teach and practice a penetration through the mastoid in the cases where they have reached or even approached the dura and see cause to open further. I believe this is bad policy, for a carious mastoid cannot be made or maintained so aseptic that it is fair to open communication between it and healthy intracranial tissues. The route may be an easy and direct one and the best line of drainage for any brain abscess that has been found; but it is far safer to make the search from separate and absolutely aseptic skull openings in the usual surgical way, since negative exploration is more likely to be harmless when thus carried out.

## CORRECTED MAL-UNION IN FRACTURES OF THE RADIUS AND ULNA OF BOTH FOREARMS.[1]

By Carl Beck, M.D.,
of New York.

Thorough adaptation of the fragments is essential to preserve the functional ability of the bones of the forearm. Fracture of either the radius or the ulna alone when perfect coaptation is not secured may prevent supination to such an extent that the unfortunate patient may be prevented from following his occupation. How much more is the functional ability impaired when, after fracture, both bones unite in false positions, with overlapping of the fragments and angular deformity.

To what extent the Röntgen rays enable us to overcome some of the technical difficulties, even in desperate conditions, is illustrated by the following case:

Both forearms of a laborer, aged thirty-four years, were caught in the wheel-strap of a powerful machine and broken. The patient was brought to the hospital, where proper efforts were made to reduce the displaced and partially splintered fragments.

At first reposition seemed to have been successful, and the swelling disappeared, but both hands remained stiff and paralyzed, and, excepting the thumbs, were without sensation.

Extensive œdema having repeatedly been present, the disturbance in motion as well as in sensibility seemed to me to be of an ischæmic nature rather than caused by a direct trauma to the nerves. The muscular atrophy, which is still present, also points to a breaking down of contractile muscular elements. By the courtesy of Dr. Norris, of Passaic, I had an opportunity to see the patient, for the first time on July 24th, three months after the injury. I then found angular deformity, abnormal mobility, and the functional disturbances described above on both sides.

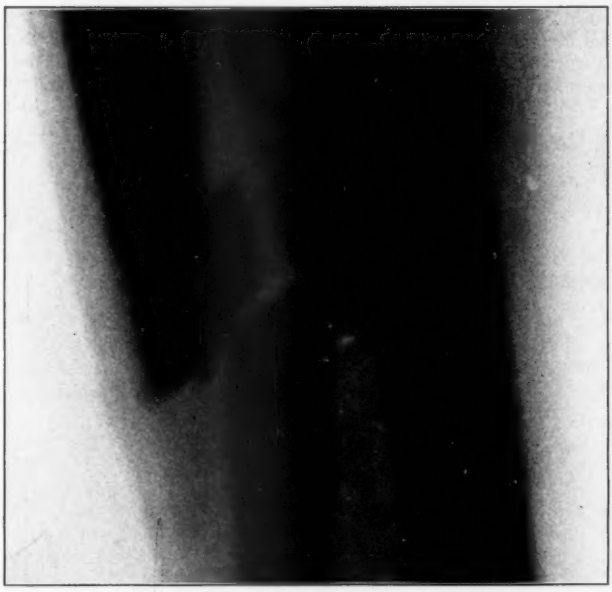
The skiagraphs of both forearms showed considerable overlapping. In the right forearm overlapping of the radial fragments existed in the middle, and lateral deviation of the ulnar fragments an inch below. The skiagraph of the left side shows the overlapping of both sides, and also the formation of a bone bridge between the lower fragment of the ulna and the upper fragment of the radius, which alone would exclude any possibility of rotation (Fig. 1).

On August 3, I concluded to correct the position of the fragments of the right forearm by exposing and freeing them. Under the guidance of the skiagraph I made a semilunar incision in an oblique direction, and overcame the shortening by resorting to forcible extension. The fragments were then united by silver-wire sutures. The *modus operandi* consisted in freeing the old adhesions thoroughly with knife

[1] Case presented to the Surgical Section of the New York Academy of Medicine, October 14, 1901.

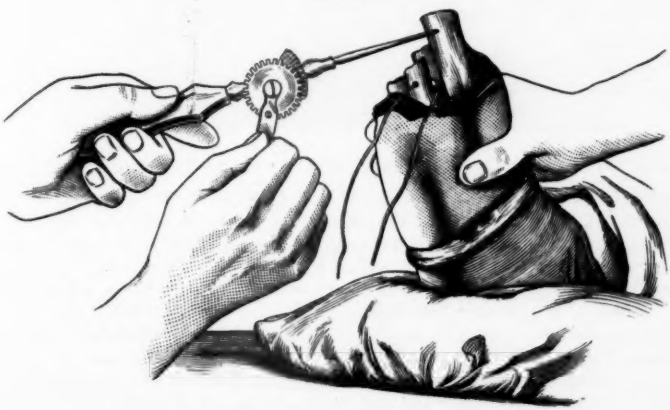
and chisel and folding the arm, so to say, completely. By encircling the two antibrachial fragments with a strong bandage the folded mass

FIG. 1.



Overlapping of fragments and formation of a bone bridge between radius and ulna.

FIG. 2.

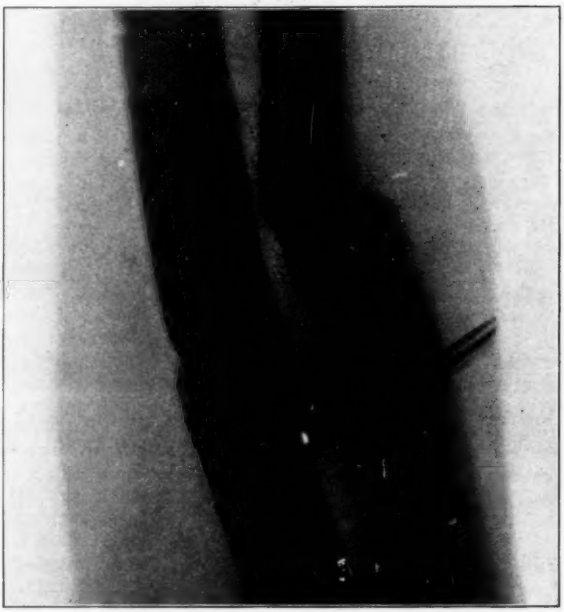


Boring holes while the forearm is folded.

could be steadied by an assistant, so that the necessary holes could be bored (Fig. 2). As shown by the skiagraph (Fig. 3), taken six weeks after this operation, the radial fragments are in ideal apposition. The ulnar fragments show slight lateral displacement, while the callus formation has assumed so fortunate a character that no other depression or protrusion remains.

Five days after the first operation the left side fracture was exposed in the same way. In spite of extensive exposure of the fractured area the fragments could not be forced into apposition except by shortening them. So I made a virtue of necessity by giving the ends of the fragments a triangular shape, which enabled me to indent them into each

FIG. 3.



Fragments wired.

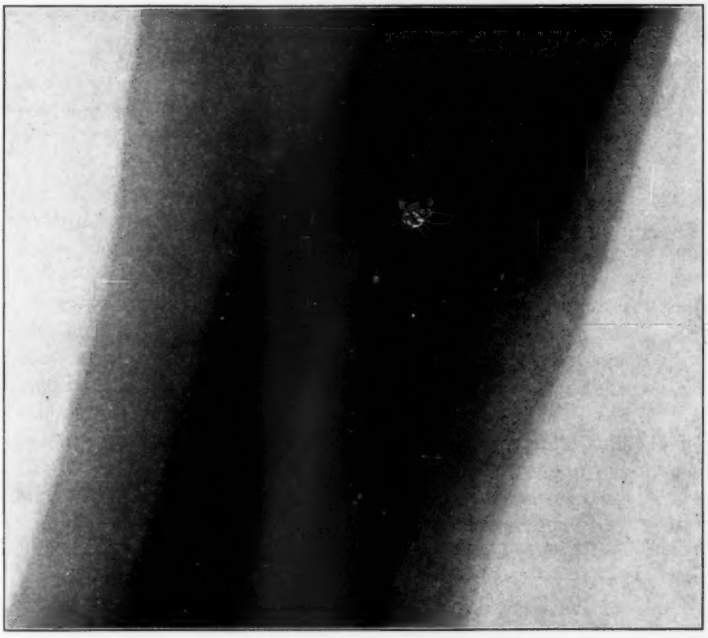
other. As the skiagraph (Fig. 4) shows, taken four weeks after this operation, the apposition of the radial fragments is perfect. The ulna does not show lateral deviation, none of the medullary lines presenting any axial divergence. The skiagraph showed, however, that there was a slight angle, which could be corrected in time by simple pressure.

Union took place by first intention without any reaction. The healing process was quicker on the left side, which is explained by the absence of wire-suturing. To be sure that consolidation was perfect, I immobilized the arm until the present time, leaving off the plaster-of-Paris splint temporarily for the employment of massage. The final result will, no doubt, be perfectly satisfactory.

Thus we see how the happy era of combined asepsis and skiagraphy permits of the correction of even the most extensive deformities in a simple and safe manner.

From a theoretical point of view it should be expected that on account of the more abundant callus-proliferation, induced by the irritation of the wire sutures, consolidation would be quicker and more thorough. But practice proved the contrary in this instance, and it seems to me

FIG. 4.



Fragments indentated.

that indentation permits of more accurate adaptation and immobilization. At the same time larger surfaces for agglutination are obtained and the soft tissues are less liable to be disturbed. The triangular indentation of the fragments should therefore be preferred, whenever possible.

The modus operandi for indentation is practically the same as demonstrated by Fig. 2.

# ALBUMINOUS EXPECTORATION FOLLOWING THORACOCENTESIS.[1]

By David Riesman, M.D.,
PROFESSOR OF CLINICAL MEDICINE, PHILADELPHIA POLYCLINIC; INSTRUCTOR IN CLINICAL MEDICINE, UNIVERSITY OF PENNSYLVANIA; VISITING PHYSICIAN TO THE PHILADELPHIA HOSPITAL.

Tapping of the chest for the removal of fluids is ordinarily such a simple and safe procedure that the possibility of serious accident scarcely ever enters the physician's mind. This feeling of security is of decided advantage, inasmuch as it insures a desirable confidence and makes resort to aspiration more prompt and more frequent than was the custom among our predecessors, by whom the gravity of the operation was greatly magnified—so much so, indeed, that many patients died for the want of timely tapping.

The knowledge that accidents may occur is not, however, a real handicap; it merely serves to make us more circumspect in performing the trifling operation, and renders us unsurprised and ready when untoward circumstances arise.

It is not my purpose to review all the complications that may accompany or follow tapping of the chest, such as syncope, pulmonary and other forms of embolism, convulsions, etc. These are adequately dealt with in the articles and works of Leichtenstern, Foucart, Dandridge, and Wilson Fox. I merely intend to give an account of one particular complication, which, although exceedingly rare, has in the past aroused remarkable interest, viz., albuminous expectoration. A survey of the literature shows that this was first described by Pinault in 1853. His patient was a man, aged thirty-four years, who had been suffering for three months with left-sided pleural effusion. Three litres of fluid were removed by tapping, with instant relief of the dyspnœa. In the evening of the same day, however, the shortness of breath returned, mucous râles appeared over the chest, and the patient began to expectorate large quantities of an albuminous fluid, bringing up two cuspidorfuls (about a pint). Cases were subsequently reported by d'Espine, in 1869; by Woillez, in 1872; by Marrotte, in 1872; by Behier, in 1872; and by Lande, in 1873. The entire subject was thoroughly reviewed in 1873 by Terrillon, who collected twenty-one observations, including his personal cases, with two fatalities.

Very little attention was bestowed upon the condition outside of France, yet it is of great interest to note that one of the first publications made elsewhere was that of Dr. William Pepper, in 1874. In a case of hydrothorax seen with Dr. T. J. Yarrow, of Philadelphia, Dr.

[1] Read before the College of Physicians of Philadelphia, December 4, 1901.

Pepper withdrew by aspiration seventy-five ounces of serum. A troublesome cough followed, but was relieved by deodorized tincture of opium. The expectoration set in eighteen hours after the tapping, and continued for twenty-four hours, the patient bringing up three gills of fluid altogether. This fluid closely resembled that removed from the chest. A dangerous syncopal attack, from which the patient was aroused by stimulants, occurred six or seven hours after the operation.

In 1873 the subject of albuminous expectoration formed the theme of a heated discussion in the Société Médicale des Hôpitaux in the Académie de Médecine. This was at the time when, through the efforts of Dieulafoy and Potain, in France, and Bowditch, in this country, aspiration was coming into use, and, as a novel method of procedure, had its advocates and opponents. This discussion stimulated the publication of numerous cases and of opinions on the etiology of the condition, and the French literature of the period contains a large number of reports, among others those of Prévost, Dujardin-Beaumetz, Moutard-Martin, Féréol, Hérard, Desnos and Drivon, and that of Laboulbène, who was one of the first to give a careful analysis of the expectorated fluid. Cases were also reported by Dieulafoy, and later by Hayem and Tissier, and others.

In the German literature I was able to find but three cases—those of Kredel, Schütz, and Scriba, although Leichtenstern, in the article already referred to, makes comprehensive reference to the condition. Strümpell also mentions it.

In England a full report of the French discussion was published by Labbée in the *British Medical Journal* in 1873, and some observations were recorded by Johnson and by Duffin. A clear account of the subject was given by Wilson Fox in his monumental work on *Diseases of the Lungs and Pleura*. The first case reported in detail seems to have been that of Gee, in 1886. A brief and interesting report of a case had been made, however, by Fraser, in 1876. West, Haviland Hall, and Hale White published cases in 1896.

In American literature, aside from the case of Dr. Pepper, I have found scarcely any reference to the subject; Bowditch was aware of the condition, but I was unable to find his original publication. Systematic writers, such as Donaldson, Osler, and Whitney, refer to the subject.

The history of the case which I have had the opportunity of observing is as follows:

Miss J. R., aged forty-eight years, born in Philadelphia; was always healthy, except for sick headaches, from which she suffered all her life, until a year ago, when, at about the time of the menopause, they disappeared. Her mother died of dropsy at the age of sixty-two;

her father is living and healthy; two sisters died at the ages of twenty-two and twenty-four years, respectively, of unknown causes, but not, it is stated, of lung trouble; an aunt died of consumption.

A year ago, at the climacteric, she began to suffer with shortness of breath and puffiness of the face and neck. She has had occasional slight cough for the past six months. From time to time she would have intense attacks of dyspnœa and orthopnœa, particularly upon slight exertion. At no time did she have any fever or any severe pain in the chest. Her appetite has always been poor, and for some time she has had slight difficulty in swallowing. Her bowels were at first constipated, but now are regular. She has been under medical treatment throughout the year of her illness. The diagnosis at first was nervousness dependent upon the change of life; more recently she has been treated for emphysema of the lungs.

Upon examination, in November, 1901, I found her to be a large, fairly well-nourished woman, with cyanosis and puffiness of the face. She was sitting up in bed and breathing rapidly and with great difficulty. The openings of the sebaceous ducts all over the face were unusually large, the lips blue, the sclera dark and cyanotic. The neck was greatly enlarged, and all the natural depressions, particularly those above the clavicles, were obliterated. Above the inner end of the right clavicle a large and hard gland could be felt. The chest was crossed by large veins, especially on the right side, above and below the breast. Resonance was impaired on the right side from the clavicle down to the liver, dulness and resistance being more marked above than below, and extending over, behind the manubrium, to the left border of the sternum. There was some tenderness on percussion near the right apex. Posteriorly there was dulness, but not flatness, at the right base, and some tenderness on percussion. Tactile fremitus was almost absent at that point. Auscultation revealed inspiration and expiration to be equal in length, and harsher over the right side in front than over the left. Posteriorly breathing was quite distinct over both lungs, inspiration being a little harsher on the right side than on the left, and expiration just below the right scapula having a distinct bronchial quality. Vocal resonance was well marked over the right side, and had a slightly twangy character. The heart did not seem to be enlarged; the apex-beat was not palpable; there was no murmur, and the sounds were not abnormal. The temperature was 97.8° F.; the pulse 108. There was a small amount of clear, tenacious sputum, which did not contain any tubercle bacilli.

The existence of the impaired resonance, diminished tactile fremitus, distant bronchial breathing, and twangy vocal resonance led me to suspect the presence of fluid; and on my second visit I made an exploratory puncture and withdrew a syringeful of clear serum. On the following day, November 11th, at noon, I tapped in the seventh interspace, postaxillary line, and by means of the aspirator drew off three pints of a somewhat turbid, yellowish fluid, frothing readily. After a little less than a quart had been removed the patient began to cough. At first the cough was dry, but toward the end of the tapping a little frothy fluid was brought up. The patient seemed to be dyspnœic and became blue in the face; and, as the cough grew more intense, I suspended the tapping and administered a small dose of morphine. As she did not seem to grow any worse under observation I

left her at 12.30 P.M. and saw her again at 6 P.M. During this interval she had expectorated about five ounces (160 c.c.) of a turbid, amber-colored fluid, covered with a layer of froth half as thick as the fluid itself, containing a few streaks of blood and some flocculi. The cough had not diminished to any great degree, but the expectoration had gradually lessened. The patient was very much more comfortable than she had been at noon and decidedly better than before the tapping. Her temperature was 99.1° F.; respirations, 44; pulse, 108. On auscultation moist râles could be detected over the entire right lung from top to bottom, and there was the most exquisite crepitation on inspiration that I had ever heard. Pneumothorax was not present. On the following day there was still a little cough, but the patient was much better than she had been for a long time. The difficulty in swallowing had disappeared, and there was good resonance over the right lung.

Unfortunately, the chest filled up again, and I had to aspirate a second time, on November 24th, this time drawing off about a quart of fluid. There was again intense cough, but no true albuminous expectoration, only a little tenacious sputum. At the last examination, made to-day, I found the chest again full to the top. The dulness behind the sternum has increased in intensity and in extent, reaching now about two inches beyond the left sternal border, and fusing on the right side with the dulness of the fluid. A large, hard gland has also appeared above the left clavicle. The signs are sufficient to warrant a diagnosis of tumor of the anterior mediastinum, probably sarcoma, which is encroaching upon the right lung and compressing the veins that return the blood from the right pleural cavity.[1]

The *aspirated fluid* was of a turbid amber color and frothy. It coagulated upon standing, the clot floating at some distance from the bottom. The circumambient fluid was clear, straw-colored, and not gelatinous. It coagulated into a moist, solid mass upon boiling, had a specific gravity of 1021, was faintly alkaline in reaction, gave the biuret test, was free from sugar, and did not form a precipitate with acetic acid. The amount of albumin present with Esbach's albuminometer was 4.5 per cent. The total solids obtained by evaporating, thoroughly drying in the water oven, and standing for twenty-four hours in a desiccator, were 6.8 per cent.

The *expectorated fluid* was of a turbid amber color, was covered with a layer of froth to the amount of about half the thickness of the fluid itself, and had a thin sediment of blood. It was gelatinous, like white of egg, and coagulated upon boiling into a solid mass. The specific gravity was 1018, the reaction neutral, the biuret test positive. There was no sugar. Chlorides were present, and acetic acid produced a distinct precipitate. The albumin amounted to 3.5 grammes with Esbach's albuminometer; the total solids were 5.84 per cent.

As the terms albuminous, albuminoid, and seroalbuminous imply, the expectoration consists of a richly albuminous or serous fluid. It is viscid,

[1] The chest was aspirated for the third time on December 6, 1901, and more than three pints of fluid were withdrawn. A severe, spasmodic cough ensued, but no albuminous expectoration.

*Addendum.* The patient died on December 19, 1901, and at the autopsy a sarcoma of the anterior mediastinum was found.

frothy, neutral or faintly alkaline, and of a yellowish or amber color, contains a little blood, and is coagulated upon boiling and by nitric acid. As a rule, it closely resembles in appearance the chest fluid. Acetic acid, as in my own case, usually gives a precipitate, suggesting the presence of mucin. Urea, hæmoglobin, and the salts characteristic of serum are present. Urobilin has also been found.

The expectoration seldom sets in during the paracentesis, but generally after an interval of from a few minutes to half an hour. In rare instances the interval has been prolonged to two hours, and in the case reported by Pepper it was apparently eighteen hours. During the interval the patient generally enjoys a marked feeling of comfort, which is suddenly terminated by dyspnœa and cough. Sometimes the latter begins before the tapping is finished. The cough rapidly becomes more intense, and expectoration increases, the patient at the same time experiencing a terrible sense of oppression, which compels him to sit up in bed. The breathing is intensely labored, the face deeply cyanosed and very anxious, the skin clammy, the pulse rapid and weak. Auscultation reveals the characteristic coarse and fine moist râles of pulmonary œdema.

In mild cases these symptoms subside gradually, the expectoration ceasing after several hours; sometimes, however, not until a day has elapsed. In extreme cases the fluid gushes from the mouth and nose in a constant stream, the patient suffering the most agonizing dyspnœa, and not infrequently dying of asphyxia—drowned, as it were, in his own juices. The amount expectorated varies with the duration and the intensity of the attack; not rarely as much as a pint or even a quart is brought up in the course of one or two hours. Gee's patient expectorated a litre in two hours; Schütz's a total quantity of 1500 c.c.

The duration of an attack is, as a rule, from one to two hours, but in some cases it has been six, twelve, twenty-four, and even forty-eight hours.

On standing, the fluid generally separates into three layers; the upper, whitish and frothy; the middle, opalescent and yellowish; the lower, denser and more viscid and containing a few whitish flocculi. In my own case there were but two layers on standing; an upper, frothy layer, and a lower stratum, twice the thickness of the upper, of opalescent fluid.

Analyses of the Fluid. I have already detailed the analysis in my own case. For purposes of comparison I give below the few analyses of the pleural and expectorated fluids that I was able to find in the literature. Many are incomplete.

1. Terrillon's case: The pleural fluid contained 1.61 per cent. of albumin; the expectoration, 1.42 per cent.

2. Foucart states that the total solids in the pleural fluids were 7.5

grammes per litre; in the expectoration they were 100.3, the albumin being 93.6 and the mineral salts 6.7.

3. Daremberg and Dujardin-Beaumetz: *a. Pleural Fluid.* Specific gravity, 1020; albumin, 66.88 grammes per litre; urea, 0.58 gramme per litre; hæmatoidin crystals, biliverdin, and a notable quantity of mucosin.

*b. Expectoration.* Specific gravity, 1010; albumin, 1 gramme per litre; urea, 2.36 grammes per litre; cholesterin and fat.

4. Drivon: *a. Pleural Fluid.* 945.28 parts water, 54.72 parts solids. Of the solids there were albuminoids 48.28, divided as follows: Albumin, 25.69; hydropsin, 22.59; mucosin, a trace; salts, 6.44 per cent.

*b. Expectoration.* 976.86 parts water, 23.14 parts solids. Of the solids there were 15.87 parts organic and 7.27 parts salts.

5. Laboulbène: *a. Pleural Fluid.* Specific gravity, 1020; total solids, 65 grammes per kilogramme. Of this 0.678 were fibrin; 7.5 mineral matter.

*b. Expectoration.* The dry residue varied from 16.47 to 24.60 on different days; the mineral matter from 3.53 to 7.8. The albumin was not estimated in the expectoration.

6. Besnier merely states that the quantity of albumin in the expectoration was double that in the effusion.

The analyses, it is seen, show enormous variations among themselves. In some cases the two fluids differed widely; in others they resembled each other very closely in composition. Regarding hydropsin, which, according to Drivon, is a substance characteristic of serous membrane exudates, I was unable to find any reliable data. Its existence is not recognized by physiological chemists of the present day.

Albuminous expectoration occurs especially after tapping in cases of acute effusion, although in my own case the effusion was unquestionably chronic. It has taken place with both left-sided and right-sided exudates and transudates. Of thirty-two cases the effusion was left-sided in eighteen, bilateral in four.

An important point, to which reference will again be made, is that in the majority of instances the amount of fluid withdrawn was inordinately large; and usually, but not invariably, the withdrawal was rapid. In some instances the simple trocar was used; in others, the aspirator. Thus there were withdrawn in the case of Woillez, 5500 c.c.; in that of Marrotte, 5000 c.c.; in Lande's two cases, 3000 c.c. and 1800 c.c., respectively; in Pinault's, 3000 c.c.; in one of Besnier's, 2600 c.c.; in Pepper's, 2400 c.c. Prévost tapped several times in the same case. At the first tapping he withdrew 1000 c.c., and there was no albuminous expectoration; at the second, 3000 c.c. were withdrawn, and the expectoration followed. Subsequent punctures were not attended by any complication. In Schütz's case 2000 c.c. were removed.

In the majority of cases complicating conditions of various kinds existed and probably played a part in the production of the phenomenon. Lande believes that the danger of albuminous expectoration is particularly to be feared when the conditions on the opposite side are such as to lessen the play of the other lung. At *autopsy* the principal change is an œdema of the lung on the affected side; sometimes of both lungs. In cases in which the pleural effusion was of the nature of hydrothorax, heart disease was found. Scriba's case is of interest because at the autopsy a fibrinous coagulum was discovered plugging the bronchi. In the case of Hayem and Tissier there was adherent pericardium.

Various theories have been advanced in explanation of the curious phenomenon of albuminous expectoration. Terrillon classifies them as follows:

1. Perforation of the lung by the trocar.
2. Spontaneous rupture of the lung.
3. Absorption by the lung of fluid remaining after the tapping.
4. Pulmonary congestion, with intense œdema.

The first three assume that the fluid expectorated is a portion of the pleural exudate; the last, that it is a transudate from the bloodvessels of the lung.

I. *Perforation of the Lung.* The identity in appearance of the two fluids and the analogy in composition, which latter, however, is not constant, suggest this view, which was first propounded by Woillez and Marrotte, and was held by Scriba and others. I may also say that when I examined and compared the two fluids in my own case I was at first inclined to this theory; but against such an interpretation are the following weighty arguments:

1. The absence of pneumothorax, which should be present if the lung has been punctured by the trocar.

2. The late onset of the expectoration. If connected with perforation of the lung it ought to set in at once, and not after an interval of half an hour or more from the time of tapping.

3. The absence of hæmoptysis.

4. The fact that albuminous expectoration has occurred especially in cases in which the effusion was very large, and the lung, of necessity, far away from the chest wall.

5. The large amount of expectoration. It is hardly conceivable that a pint or a quart of fluid could, in a short space of time, pass through such a small opening as would be made by the point of a trocar.

6. In some instances the expectoration occurred several times in the same case. Thus the patient whom Behier tapped four times had albuminous expectoration each time; and in the patient of Gee every one of three tappings was followed by albuminous expectoration. It

is unlikely that the lung in these cases was punctured so many times. Moreover, both writers state that, warned by their first experience, they afterward tapped with the greatest care, so as to avoid wounding the lung.

7. In none of the fatal cases was any perforation of the lung found post-mortem. This, to be sure, is not an argument of great force, for it is proverbially difficult to discover perforations in cases of pneumothorax and of empyema rupturing into the lung; but, on the other hand, the argument is not to be held too lightly, since, death being so much more prompt in albuminous expectoration than in pneumothorax or empyema, the chances of finding a perforation should be better.

II. *Spontaneous Perforation of the Lung* is the view defended particularly by Féréol. The excessive rarity of serous effusions perforating into the lung is against this. Furthermore, there is no reason why it should occur just at the end of tapping; and this, together with the non-development of pneumothorax, the failure to find the perforation at autopsy, and the absence of the auscultatory signs of pleurobronchial fistula, is sufficient to dispose of this theory.

III. *Absorption of the Fluid by the Lung.* This is an illogical view, for it must at once be apparent that the absorption or sucking up of the fluid through the stomata of the lung would cause it to enter the lymphatic system and not the bronchi.

IV. *Pulmonary Œdema.* This theory was first advanced by Pinault and was strongly advocated by Behier. It is the one adopted by Pepper, West, and most recent writers. In support of it we have the following arguments:

1. The onset of the expectoration a little while after the tapping is completed.

2. The physical signs of œdema—crepitant and subcrepitant râles—are present.

3. Œdema of the lungs is the chief lesion found in those organs at autopsy.

4. The occasional development of albuminous expectoration in the absence of pleural effusion. Thus Foucart reports a case in which it occurred in a patient with heart disease without pleurisy, and Woillez observed it twice in emphysematous asthma and once in aneurism of the aorta. In his cases the expectoration did not contain any mucin.

5. The occurrence of the phenomenon after tapping in empyema, as in the case of Fraser. The rarity of albuminous expectoration after the evacuation of a pyothorax has been well explained by Curtin, who ascribes it to the fact that, owing to the thickness of the fluid, the abstraction is necessarily slow.

6. The chemical composition of the two fluids tells both for and

against the œdema theory, inasmuch as the fluids sometimes differ and sometimes appear to be almost identical; but, as it is not possible to discover any clinical difference between the two groups of cases, it is fair to assume that, even when the expectorated fluid most closely resembles that from the pleura, its origin is the same as when it differs the most widely.

7. In the majority of cases in which albuminous expectoration occurred the amount withdrawn was excessively large; in many instances, but not in all, the withdrawal was also rapid.

8. As stated by West, theoretical grounds are in favor of this view. The compressed lung is suddenly released from pressure, and there is naturally a great afflux of blood. A congestion follows, for which I should like to propose the name of *congestion by recoil*. It is true that it has been shown that an increase of pressure in the pulmonary circulation is not alone sufficient to produce œdema; but we have in the condition here considered more than mere pressure—we have vessels that, by reason of their prolonged compression and the altered circulatory conditions, have suffered a change in their walls, by reason of which they are rendered more permeable. A transudation occurs into the air vesicles, which finds its way into the bronchi, and is expectorated. It is possible that the negative pressure exerted upon the heart by the expanding lung, intensifying the diastolic relaxation of the organ, and thus embarrassing its action, is a factor in the production of the phenomenon. This negative pressure effect was first adduced by Dr. Mary Putnam-Jacobi in explanation of the sudden syncope sometimes following thoracocentesis. Lande was of the opinion that the œdema was due to the irritation of the air rushing into the expanding lung, while Johnson believed that it was favored by the existence of thrombosis in the vessels, the result of the long-continued compression and stagnation of the blood. This, however, is not tenable, because such a thrombosis would produce infarction, and of the existence of this there is no evidence in cases of albuminous expectoration. Duffin's view of a vasomotor paralysis of the vessels, in consequence of the prolonged compression, is not unreasonable, and helps to account for the congestion; but whether it be through a paralysis or through a nutritional change in the vessel walls, there is, in either case, a relaxation and a sudden afflux of blood to the expanding lung. The subsequent event—the transudation of serum—is best explained on the assumption of an alteration in the walls of the capillaries and small veins, such as Cohnheim has assumed follows prolonged compression.

TREATMENT. The cough is usually so intense that, despite the apparent contraindication of the drug, morphine cannot be dispensed with, at least in the severer cases. It is advantageously combined with atropine. Counter-irritation, in the form of mustard or dry cups,

should also prove of value. Artificial respiration and venesection suggest themselves as theoretically beneficial. The former has had a practical trial in one case, without avail; the latter, so far as I have been able to determine, has not been employed.

CONCLUSIONS. 1. Albuminous expectoration is a very rare complication of thoracocentesis. It is usually serious and sometimes fatal.

2. It consists in the expectoration of a viscid albuminous fluid closely resembling the fluid of serous effusion.

3. The condition is best explained on the basis of an intense congestion and œdema of the lungs (congestion by recoil).

4. The principal cause seems to be either too rapid or too great a withdrawal of fluid.

5. Serious cardiac disease and morbid conditions of the opposite lung, hindering expansion, are predisposing causes.

6. Under all circumstances, but particularly when these complications exist, aspiration should be performed slowly. If the effusion is large the amount withdrawn at any one time should be moderate.

7. In some cases it may be wise to perform several tappings, drawing off a small quantity each time.

8. The treatment consists in counter-irritation, venesection, and artificial respiration, together with the use of morphine if the cough is severe.

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## PRIMARY TUBERCULOSIS OF THE LIVER.

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There is no organ of the body free from the attacks of the tubercle bacillus, and probably the most frequently involved, if we exclude the pulmonary apparatus, are those of the abdominal cavity. These processes involving the intestinal canal, especially in children, whether it be in the form of primary or secondary ulcerations, have long been recognized and very thoroughly studied. Secondary manifestations are quite common in all organs, and are so frequent that their absence in those dead of tuberculosis is unusual.

Since improvement in our pathological examination, and since we have become more careful in the study of specimens and of cases, with advanced methods of clinical research our knowledge of tubercular lesions has broadened, and many changes thought formerly to be always secondary are now recognized as occurring as primary manifestations in many instances. This applies with especial force to peritoneal tuberculosis and to tuberculosis of those viscera inclosed by the peritoneum. As an example we have the studies of Williams in pelvic disease, his statistics showing that probably 8 per cent. of tubal diseases are due to tubercular infection. The seminal vesicles may in like man-

ner be the starting-point of the disease, the peritoneum or the general system becoming later involved. In some instances the seat of primary infection may be entirely overlooked, or there may be no trace in other instances of the manner in which the organisms have gained entrance into the body.

Although the liver rarely escapes in the secondary or disseminated forms of the disease, observers are a unit as to the infrequency of the disease in this organ as a primary affection; and so true is this that such instances are looked upon as having interest rather from the stand-point of pathologico-anatomic curiosities than any other. The disease is described as occurring in three forms in the liver, though Osler, including the type in which the bile vessels are first attacked, says it may show itself in four ways: (*a*) General tuberculosis; (*b*) tuberculosis in the finer bile vessels, which produces tubercles of various sizes, often bile-stained and frequently caseous in the centre, giving the appearance of small abscesses; (*c*) large, coarse, caseous masses (these being the large tubercular abscesses), and in the form of (*d*) tubercular cirrhosis.

While it is true that the disease of this organ is rare as a primary affection, and that most frequently organs easily accessible are first attacked, the bacilli may, as stated above, obtain entrance into the blood currents or lymph channels and attack the internal organs, leaving no trace of their mode or place of entrance or primary infection. It has been shown that in the fœtus the liver may, however, be regarded as the primary seat of the affection.

Sabourand, in 1891, showed the liver and spleen of a child, aged eleven days, which were beset with numerous miliary tubercles; the mother suffered from congenital tuberculosis. Another observer has reported a case in a child, aged fifteen days, the disease being, however, so extensive as to preclude post-natal infection. In these cases the infection is probably through the umbilical vein from the placenta, and may be looked upon as primary in character.

Hanot says the disease may be primary, although very rare; and he describes the forms of tubercular hepatitis, viz.: (1) Acute or fatty hypertrophic liver; (2) subacute or fatty cirrhotic; (3) the fat, tuberculous liver, which later is at the limit of latent forms which have a clinical expression, with a slow increase in the size of the organ. The duration of the disease, he says, is from four to twelve months.

In Macaigne and Finet's case of diffuse nodular hepatitis the infection was secondary, the nodular development having its centre in the portal system, through which it was considered that the infection may have occurred.

That this does often occur we cannot doubt when we consider the portal circulation in its connection with the intestinal tract and the

frequency with which the bowel may be the seat of lesions not only secondarily but primarily.

Remembering, then, that the tubercle bacillus, like others, may obtain entrance into the body and leave no trace of its mode or place of introduction; that tubercle bacilli may find their way into the intestinal tract and produce lesions here without disease higher up in the alimentary canal, and that the blood from the intestinal canal passes through the liver by way of the portal circulation, it seems we might find primary hepatic tuberculosis far oftener than we do. Fletcher regards the portal veins as paths of infection, and in the case herewith reported we believe the infection to have taken place in this way, the clinical history and autopsy seeming to bear out the assumption.

The patient, Mr. K., aged forty-four years, was seen in consultation with Dr. Florence Brandeis, first in June, 1901, he having been ill for several months, with almost daily chills, followed by elevation of temperature. This had been diagnosed as malaria, and he was given the usual quinine treatment therefor. The history obtained was about as follows: He had lived in Louisville most of his life, and five years ago moved to New Orleans and engaged in business. During his stay there he had an attack of dysentery, which was quite severe, confining him to bed for two or three months, and from which he did not fully recover until his return to Louisville, about eighteen months ago. He had not been ill before that time, and remained in good health after his return until about five months ago. His family history is good, and there is no history of syphilis or other disease of importance than that above given.

During his present illness he has complained mostly of pain in the abdomen, quite severe at times, especially over the liver; also in the right hypochondrium and in the epigastrium. He has had frequent chills, and fever more or less constant, the temperature range being as high as 103° to 105° F. Profuse night-sweats have been a source of constant annoyance.

At present he is somewhat jaundiced and much emaciated. The abdomen is distended, especially at its lower portion. There is some pain in the upper abdomen, most marked to the right of the left costal margin, about on a line with the eleventh rib. The liver is considerably enlarged, the left lobe extending over to the median line and three fingers'-breadth below the border of the ribs; the right lobe extends three inches lower than normal. There is some tenderness over the gall-bladder region; pulse, 110; temperature, 102° F.; skin dry, harsh, slightly jaundiced; stools clayey and odor marked; urine contains bile-pigment; blood examination shows nothing abnormal.

He was sent to the infirmary for observation, we thinking we had to deal with a case of suppuration and adhesions about the gall-bladder, or maybe with a case of hepatic abscess, with localized peritonitis of a slow type. After watching him for several days—the urine and blood being repeatedly examined, although nothing further was thereby discovered—a slight ascites was noticed. We concluded, after the week's observation, that our first diagnosis was incorrect and that the case was probably one of tubercular peritonitis. Exploratory operation was advised and carried out June 15, 1901.

Operation by incision in the right linea semilunaris, at the margin of the liver. The gall-bladder and liver present. There are numerous dense adhesions between the liver and the parietal peritoneum, which are partially separated; the gall-bladder is distended, and there are a few omental adhesions about it; omentum also adherent at the margin of the liver. No pus in the gall-bladder or any stones either in the gall-bladder or ducts. The liver presents numerous small nodules, especially along the lower margin, where the omentum is adherent, which have the characteristic appearance of miliary tubercles. Some enlarged glands are felt posterior to the foramen of Winslow. There is a small cyst on the anterior surface of the liver, about midway between its upper and lower border, which upon aspiration yields a clear fluid. Liver densely adherent to the diaphragm. There is some fluid in the abdominal cavity, and the omentum presents a few tubercles here and there. The intestines are free; no tubercles upon them. No enlarged mesenteric lymphatics. Stomach not adherent. Appendix normal and not removed. All the abdominal organs examined, and nothing abnormal noted.

A portion of the thickened peritoneum over the liver, where it had been adherent, as also a portion of the omentum, was removed for examination by Prof. Carl Weidner, who reported that he found no tubercle, nor were any bacilli found in the fluid from the small cyst which was aspirated. After drying the cavity thoroughly the incision was closed by interrupted buried sutures of catgut, with continuous silkworm-gut for skin. A post-operative diagnosis of primary tuberculosis of liver was made.

Convalescence normal. Bowels moved on the third day, and since the operation temperature remains normal and sweats have ceased. He expresses himself as feeling decidedly better.

*June 29th.* Discharged from the infirmary. The next entry in my notes is July 5th, when he was seen at his residence. He has had no sweats or temperature. His appetite has improved, as has his color, and he has gained in strength. He is up and about some each day.

*July 29th.* I note he is beginning to have some temperature daily; night-sweats returned, abdomen ascitic, feet œdematous; and it is thought he will develop a general tuberculosis.

He remained under the care of Dr. Brandeis, going from bad to worse, until September 19th, when he died of exhaustion, having presented in his later days all the symptoms of a general abdominal tuberculosis. Shortly before death he had several small, hemorrhagic stools, the fecal matter being slightly streaked with blood.

At the autopsy, which was done September 19th, by Dr. L. L. Solomon, the following conditions were noted:

The liver was densely adherent to the parietal peritoneum and to the diaphragm, also much enlarged, measuring sixteen inches in its transverse by twelve inches in its longitudinal diameter. The left lobe was about as large as the right. The organ was congested and full of blood. There are present on the surface as well as throughout the liver, as shown by incision into it, numerous nodules, varying in size from a millet-seed to that of a pea. Many of these nodules have undergone caseation. There is a decided increase in the connective tissue.

The spleen is enlarged, dark red, and full of blood. Studding the surface and throughout the organ are nodules similar to those in the liver.

The kidneys are slightly enlarged and congested.

The omentum is studded with the same variety of nodules noted above.

The intestines are covered with small nodules, especially about the caput coli and the appendix vermiformis. The latter is adherent by its tip at the brim of the pelvis.

The mesenteric glands are enlarged, many of them caseous. In the posterior fold of the foramen Winslowii are several enlarged glands.

There are about three pints of fluid free in the cavity; no other lesions noted.

The process was certainly most advanced in the liver and spleen; next in the glands.

Microscopical examination of the structures—*i. e.*, liver, spleen, glands, and peritoneum, made by Dr. J. E. Hays—showed the nodules to be tubercular and to present various stages of the process, even to caseation.

In reviewing this case and such literature as I have at hand the following conclusions appear to me to be justified:

1. That primary tuberculosis of the liver, though rare, may occur.
2. That the infection may take place by way of the intestine and the portal circulation, the bacilli finding entrance through an ulcer in the bowel (which in this case was at the time of illness some time since), and leave no trace of the place of entrance into the body.
3. That tuberculosis of the liver may infect the other abdominal viscera and also the peritoneum secondarily.
4. That the process may cause a great increase of the connective tissue in the liver (interstitial hepatitis).
5. That the disease results fatally within twelve months.

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## ON THE ASSOCIATION OF STONE AND TUMOR OF THE URINARY BLADDER, WITH REPORT OF A CASE.

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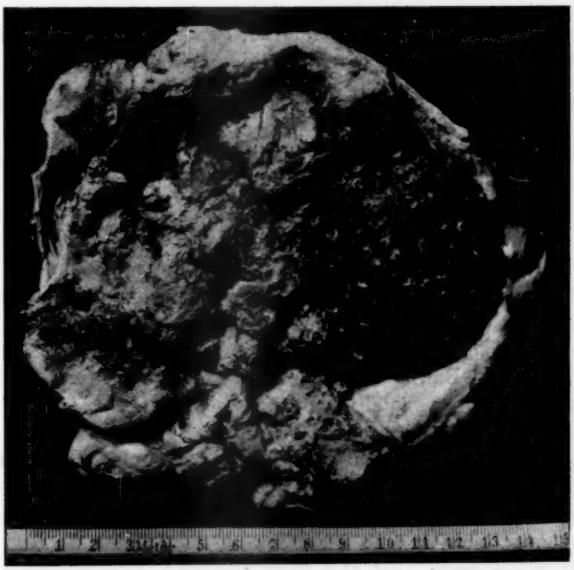
Definite reference in the literature to the co-existence of calculus and tumor of the urinary bladder are few indeed. The articles by Rösen, Kolozek, Colley, Swediar, Rochet, and Ohdedar are the only ones in the English, German, and French languages whose titles indicate directly that they are concerned with this subject.

Until recently this subject has received from authors of text-books passing notice only, and even in such works as those of Sir Henry Thompson, Barling, Fenwick, and others, the statements concerning it are very brief. There has been no attempt to show an etiological relationship between the two conditions.

The following is an interesting case of this nature:

Harry F., aged thirty-five years, tailor, American, entered the Cook County Hospital of Chicago, June 9, 1898. The history obtained from his brother is as follows: The patient has had difficulty of micturition nearly all his life. Had scarlet fever two years ago, and has been deaf and dumb ever since. About three months ago he came to his brother complaining of pain in his back and troubled with frequent micturition. Since that time he has lost much flesh and has had constant pain in the back, and during the past month over the pubes.



Vesical calculus, with carcinoma (from above case).

Upon physical examination a large tender mass extending from the pubes half-way to the umbilicus is found. On rectal examination a smooth, firm mass is felt, filling the pelvis. A few cervical glands are palpable. The clinical diagnosis of sarcoma of the bladder was made. The patient died July 8, 1898, thirty days after admission.

Autopsy (Dr. Hektoen) twenty-four hours after death: no changes of special interest are found, with the exception of those in the urinary organs.

The pelvic cavity is filled with a mass composed of urinary bladder and coils of the lower part of the ileum. This mass is adherent to the anterior abdominal wall and covered by adherent omentum. On separating omental adhesions, a soft tumor mass occupying the urinary bladder is broken into. On removing the bladder the entire wall above the trigone is infiltrated with a grayish-white tumor which completely fills the cavity, the mucous surface of which is necrotic, the wall in places being 3 cm. in thickness. In places the wall has been broken through by the tumor tissue, forming subserous nodules, the largest being the size of a hickory-nut. Lying in the lower segment is a large round stone, having upon its surface warty excrescences, and weighing 150 grammes. The mucous membrane of the ureters is slaty in color and roughened. The ureters and pelves are dilated and contain grayish pus. The kidney substance is atrophied. The capsule is free. The rectum is not involved.

*Anatomical Diagnosis.* Carcinoma of the urinary bladder. Vesical calculus. Cysto-uretero-pyelonephritis. Adhesive pleuritis. General marasmus.

The microscopical examination of the tumor verifies the anatomical diagnosis.

Remarks. There are several considerations which lead us to believe that in this case the stone preceded the tumor formation.

1. The much more frequent occurrence of uncomplicated cases of stone than of tumor.

2. The extreme rarity of uncomplicated carcinoma of the urinary bladder at this age.

3. The long-continued urinary disturbances (30 years) and the mildness of the symptoms. It would be unreasonable to suppose that a tumor, particularly a carcinomatous growth, should have existed for so long a period and have given rise to such slight disturbances. According to Albarran, Barling, Hamilton, and others, carcinoma of the urinary bladder proves fatal within three years.

4. The large size and character of the stone. The excellent researches of Pitha show that a phosphate of lime calculus, under the most favorable conditions may increase 20 to 40 grammes (6 to 12 drachms) per year, and a stone of calcium oxalate may, under the most favorable circumstances, increase 4 to 8 grammes (1 to 2 drachms) per year. Thus it would seem that this stone weighing, approximately, 150 grammes (40 drachms), was the cause of the trouble in micturition of which the patient complained for so many years.

From an extensive review of the literature, the following cases of calculus and tumor of the urinary bladder have been collected and tabulated:

| No. | Sex, age, occupation. | Clinical diagnosis. | Kind of calculus. | Kind of tumor. | Other changes. | Seat of tumor. | Authors.[1] |
|---|---|---|---|---|---|---|---|
| 1 | M. 42 | Carcinoma vesicæ. | Mulberry oxalate (43 gms.) | Carcinoma (squamous-celled). | Left. Hydronephrosis with pyelonephritis; right kidney is atrophic; metastasis in regional lymph glands. | Anterior wall. | Rösen, L. |
| 2 | M. 33 | Urinary calculus. | Mulberry oxalate. | Carcinoma. | Passive hyperæmia of kidneys; hypertrophic cirrhosis; adhesive peritonitis about tumor growth. | Anterior wall. | Ibid. |
| 3 | F. 64 | Tumor of the bladder | "Phosphatic gravel," | Villous cancer. | Right. Pyelonephritis; dilatat'n of right ureter; muscularis is infiltrated; metastasis in regional lymph glands. | Lower segment. | Watson, P. |
| 4 | M. 51 painter | Stone and tumor of the urinary bladder. | Oxalate of lime coated with phosphates. | Epithelioma. | Left renal calculus with pyelonephritis; metastatic nodules in liver; metastasis in regional lymph glands; pneumonia. | Posterior wall. | Colley, J. N. C. |
| 5 | M. 60 sailor. | Stone and tumor of the urinary bladder. | ..... | Carcinoma. | Metastasis in the regional lymph glands. | Anterior wall. | Fenger, F. |
| 6 | M. 65 sailor. | Vesical calculus at 14 years. | ..... | Carcinoma. | Right. Chronic nephritis; carcinomatous nodules in right kidney; adhesive pericarditis. | Posterior inferior wall. | Hastington, J. F. |
| 7 | M. 56 | Stone and tumor. | ..... | Squamous epithelioma. | Interstitial nephritis; cirrhosis of liver; cheesy foci in apices of lungs; adhesive pleuritis. | ..... | Hughes, W. E. |
| 8 | M. 47 | ..... | ..... | Carcinoma. | Right. Chronic diffuse nephritis. Left. Kidney substance absorbed; hydronephrosis. | Posterior wall. | Loomis, H. P. |
| 9 | M. 35 | Sarcoma of the bladder | Weight 150 gms. | Carcinoma. | Cysto-uretero-pyelonephritis; adhesive pleuritis. | Whole interior. | Present case. |
| 10 | M. 50 | ..... | Uric acid size of small apple | Carcinoma. | ..... | Posterior wall. | Birch-Hirschfeld. |
| 11 | M. 30 | Vesical calculus. | ..... | Squamous epithelioma. | Pyelonephritis; metastasis in kidneys. | Lateral inferior wall. | Kolozek. |
| 12 | M. 45 | Large calculus. | ..... ..... | Squamous epithelioma. | ..... ..... .... | Anterior wall. | Assendelft, E. |
| 13 | M. 47 | ..... | Large stone | Carcinoma. | ..... | Base and prostate. | Ibid. |
| 14 | M. 47 | Large stone | "Huge calculus." | Ulcerative carcinoma. | ..... | Base. | Ibid. |
| 15 | M. 60 | Tumor and stone. | "Phosphatic." | Villous cancer; papilloma removed previously. | Metastases in ileum, head of femur and lung. | ⅔ inner surface. | Watson, F. S. |
| 16 | M. 54 gardener. | Tumor of the urinary bladder. | "Phosphatic gravel." | Carcinoma. | Multiple abscesses of kidneys; metastases in regional lymph glands and lungs. | Anterior inferior wall. | Bode, E. |
| 17 | M. 69 hotelkeeper. | Stone and cancer of bladder. | "Several small calculi." | Carcinoma. | Right. Chronic diffuse nephritis; cirrhosis of liver, adhesive pleuritis. | Base and prostate. | MacGowan, G. |
| 18 | M. 35 | Stone and cancer. | Phosphatic | Carcinoma. | ..... | Left inf. wall. | Fenwick, E.H. |
| 19 | M. 79 | ..... | Phosphatic | Carcinoma. | ..... | Base and prostate. | Johnson, R. |
| 20 | M. 55 | Tumor. | Phosphatic | Cancer. | ..... | Anterior wall. | Douglas, J. |

[1] For references see alphabetical list at end of article.

| No. | Sex, age, occupation. | Clinical diagnosis. | Kind of calculus. | Kind of tumor. | Other changes. | Seat of tumor. | Authors.[1] |
|---|---|---|---|---|---|---|---|
| 21 | M. 32 | Cancer of bladder. | Phosphatic | Epithelioma (papilloma removed previously). | ..... | Right lateral wall. | MacGowan, G. |
| 22 | M. 57 | ..... | ..... | Carcinoma. | Metastasis in kidneys; double hydronephrosis atheroma of ascending aorta. | Entire wall. | Haake, O. |
| 23 | M. 43 merchant. | Tumor and stone. | "Brownish," wt. 40 gms. | Small r'd-celled sarcoma. | ..... | Inferior wall. | Krause, L. J. |
| 24 | M. 59 | Stone and tumor of urinary bladder. | Uric acid, wt. 20 gms. | Myxosarcoma. | ..... ..... | Diffuse. | Obdedar, M.N. |
| 25 | F. 50 housewife. | Cystitis. | "Gravel and small stones." | Medullary sarcoma. | Sacral lymph glands are enlarged. | ..... | Williams, W.R. |
| 26 | M. 6 | Calculus and tumor. | "Small impacted." | Myxosarcoma. | Double hydronephrosis | Diffuse. | Southan, F. A. |
| 27 | M. 50 clergy. | ..... | "Phosphatic concretions." | Sarcoma. | ..... ..... | Base of bladder. | Skillern, S. R. |
| 28 | M. 67 | Stone and tumor of urinary bladder. | Uric acid. | Papilloma. | ..... ..... | ..... | Thompson, Sir H. |
| 29 | F. 34 | Tumor of bladder. | Phosphate of lime. | Papilloma. | ..... | Base. | Norton, A. |
| 30 | M. 38 laborer. | "Phosphatic gravel." | "Phosphatic gravel." | Papilloma | ..... | Anterior wall. | MacGowan, G |
| 31 | M. 47 | Stone and tumor of urinary bladder. | ..... | Fibropapilloma. | ..... | Anterior inferior wall. | Ibid. |
| 32 | M. ... | Tumor. | "Stony concretions." | Papilloma. | ..... | Lateral inferior wall. | Wendell, W. |
| 33 | F. 45 housewife. | Tumor. | "Phosphatic gravel." | Papilloma. | ..... ..... | Left inferior wall. | Vander Veer, A. |
| 34 | M. 29 | Tumor and calculus of bladder. | Oxalate & phosphate of calcium. | Polypus. | ..... | ..... | Thompson, Sir H. |
| 35 | F. 43 | Tumor. | Phosphatic | Polypus. | ..... | Inferior wall. | Hill, B. |
| 36 | M. 56 | Stone and tumor. | "Phosphatic concretions." | "Villous." | ..... ..... | Lateral inferior wall. | Thompson, Sir H. |
| 37 | M. 67 | Stone. | Uric acid, wt 15 gms. | ..... | ..... | Lateral wall. | Ibid. |
| 38 | M. 67 | Stone of bladder. | "Walnut-sized." | "Pedunculate." | ..... | ..... | Schrey, H. |
| 39 | M. 34 | Ulcer of bladder. | "White stones." | "Ulcerative." | ..... | Posterior wall. | MacGowan, G. |
| 40 | M. 62 weaver. | Stone, | "Gravel." | "Fungus." | Right. pyelonephrosis. with eight renal calculi; nodules in liver. | ..... | Douglas, J. |
| 41 | F. 79 | Cystitis. | Phosphatic | "Fungus." | ..... | ..... | Ibid. |
| 42 | ..... | Urinary calculus. | Phosphatic | ..... | ..... | Base. | Anderson, W. |
| 43 | M. 53 | Encysted calculus. | Phosphatic | "Malignant." | ..... | Anterior wall. | Post. |
| 44 | M. 40 | Calculus. | Weight 40 gms. | "Fungus." | ..... | Base. | Swediar, F. |

[1] For references see alphabetical list at end of article.

In this series of 44 cases, 37 occurred in males; 6 in females; and in one the sex is not given. The average age of the cases is 48 years. The ages range from 6 to 79 years. In two cases the age is not given. The following table shows the cases by decades:

| *Age periods.* | *Carcinomas.* | *Sarcomas.* | *Benign tumors.* | *Total.* |
|---|---|---|---|---|
| 6 to 20 years | 0 | 1 | 0 | 1 |
| 21 " 30 " | 1 | 0 | 1 | 2 |
| 31 " 40 " | 4 | 0 | 3 | 7 |
| 41 " 50 " | 6 | 3 | 3 | 12 |
| 51 " 60 " | 7 | 1 | 3 | 11 |
| 61 " 70 " | 3 | 0 | 4 | 7 |
| 71 " 80 " | 1 | 0 | 1 | 2 |
| | 22 | 5 | 15 | 42 |

The clinical diagnosis was either not made or not given in 8 of the cases. Of the remaining 36, the diagnosis of stone was made 10 times, tumor 10 times, both calculus and tumor 13 times, cystitis twice, and ulcer of the bladder once. The mulberry or oxalate of lime and uric acid calculi each occurred 4 times; the phosphatic calculus 12 times; and in the remaining cases no mention is made of the character of the stone.

A microscopical examination was made in all but three of the cases of carcinoma and sarcoma, and in these the malignancy is verified by metastases. This gives 22 carcinomas; 5 sarcomas; 5 papillomas; 2 polypi, and 2 fungus growths, while the remainder are given as " malignant," " villous," " ulcerative," or undesignated. In this series the tumors are all primary, except possibly four cases, reported respectively by Assenfeldt, Johnson, MacGowan, and Hastington. In the first three, the prostate was simultaneously involved, and in the latter it was doubtful which was primary, the carcinoma of the bladder or that of the right kidney.

A close study of the clinical history and post-mortem findings in these cases shows that the stone was primary in 18 and the tumor in 8 instances, while in the remainder it is impossible to state with any degree of certainty which of the two conditions was primary.

Other lesions besides those in the bladder are given in twenty instances. Of these, ascending uretero-pyelonephritis with dilatation is the most common. Metastases in the neighboring lymph glands occurred in a considerable number of the malignant tumors. Metastatic nodules occurred in two instances each, in the lungs and liver, and three times in the kidneys. It is quite generally known that especially distant metastases in carcinoma of the urinary bladder are not so frequent as in carcinoma elsewhere (Barling), and if it occurs at all it occurs late in the disease.

In 21 cases the seat of the tumor is given as the lower segment; in 9, the anterior wall; in 5, the posterior wall; in 3, the lateral walls; and in 3 as diffuse; while in the remaining cases no mention of the location is made.

What relation is there between calculus and neoplasm of the urinary bladder? Is the combination merely accidental? Does tumor enhance the likelihood of the development of calculus? Or, finally, does calculus by its influence increase the liability to the development of new growth?

The number of cases of calculus and tumor that I have collected seems altogether too large to be regarded as the result of accidental coincidence, and especially so when the rarity of tumors of the urinary bladder as a whole is considered. Küster says that tumors of this organ constitute only one-half per cent. of all tumors. Heilborn and Hasenclever found in the Berlin Pathological Institute only 10 primary carcinomas of the urinary bladder in 20,000 post-mortems from 1859 to 1880. According to the statistics of Ditel, Zuckerkandl, Guyon, Bozy, Israel, Fenwick, Keyes, Hamilton, Podrazki, and others, carcinoma occurs in a little over half of all tumors of the urinary bladder. Hence, since tumor occurs so infrequently, it would seem that the number in which the combination of calculus and tumor exists is too large to be explained as accidental.

The following arguments favor the view that tumor increases the liability to the formation of calculus:

1. In 8 cases of our series there is no question but that the calculus was probably secondary to the tumor.

2. Tumors, especially of the malignant type (Barling, Fenwick, and others), are not infrequently found incrusted with phosphatic material.

3. Villous growths are especially liable to cause calculi, because a poorly nourished projecting villus while yet attached, or when torn off, may afford a nucleus, much the same as a foreign body around which urinary salts are deposited.

The following points may be considered as evidence that vesical calculus is a factor in the etiology of tumors of the bladder, by causing primarily a "mechanical irritation," followed by inflammatory hyperplasia, the "inflammatory tumor," of Leichtenstern, which may be transformed into true neoplasms, as shown by Wendel, Zuckerkandl, and others.

1. In over half of the cases it appears that the stone was primary in point of time.

2. Inflammation of the urinary bladder caused by irritation other than that produced by a calculus has been found to cause an increased liability of new growths. Wendel and Leichtenstern have shown that this not infrequently occurs in individuals who are subject to inflammation of the urinary tract from the constant inhalation of the poisonous vapors from aniline dyes. Albarran, Bernhard, and others report cases in which tumors undoubtedly resulted from chronic hyperplastic inflammation caused by the parasite Bilharzia hæmatobia. Störk claims

that in one of his cases a carcinoma developed from a cystitis cystica. Fagge believes that a carcinoma was the result of irritation from the use of the catheter for thirty years. Kaufman, Thoma, Watson, Rösen, Colley, Zuckerkandl, Rochet, and others believe that chronic inflammation is present in the majority of all tumors of the bladder, and my study of reported cases corroborates this view. Hence, it is permissible to conclude that if inflammation caused by chemical, bacterial, and parasitic causes enhances the likelihood of tumor growth in the urinary bladder the mechanical irritation from a calculus may have the same effect. Orth goes so far as to say that papillary growths are the result specially of the chronic inflammation produced by stone.

3. Tumor of the urinary bladder uncomplicated by stone occurs more frequently in the lower segment, (Fenwick, Keyes, Barling, Küster, Haake, Birch-Hirschfeld, Hasenclever, and others). This is also apparent in this series. In the uncomplicated cases the posterior wall is affected more often than the anterior, the favorite site being at or near the orifices of the ureters, (Keyes, Fenwick, and others), while in the cases with calculus we find the anterior wall to be the seat of the tumor in nearly twice as many instances as the posterior wall. In explanation of the more frequent involvement of the lower segment different views are held, one being that the tumor arises from the prostate; but against this is the fact that in this series, as well as in all primary urinary bladder tumors, the more frequent involvement of the lower segment prevails alike in both sexes. A more plausible explanation, and one held almost universally, is the greater irritation of this portion both by chemical and mechanical influences. The more frequent involvement of the anterior wall in this series, where calculus is present, in our opinion, must be ascribed to the influence of the stone.

4. The large number of cases in which the calculus was primary in point of time and the fact that both calculus and tumor occur more frequently in the male sex and nearly at the same age may be taken to indicate that the calculus was not without etiological influence in the development of the tumor.

5. Since in 90 to 95 per cent. of primary carcinoma of the gall-bladder, biliary calculi are present (Tillman, Siegert), analogy would lead us to expect a somewhat similar relation between stone and tumor in the urinary bladder.

Hence, the conclusion may be drawn that, contrary to the views of Neelsen, Busse, and others, an etiological relationship between calculus and tumor is not to be denied altogether, and calculus seems to favor the development of tumor in a larger percentage of cases than tumor favors the development of stone.

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# A CASE OF STOMATITIS GANGRENOSA (NOMA).

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This disease is frequently called noma, and sometimes cancrum oris. It is characterized by a gangrenous destructive process located on the cheek. Although the left cheek is the favorite site of the disease, it can frequently be found on both cheeks. The writer has met with children suffering from this disease on the right cheek. Girls are more liable to noma than boys. It is usually secondary to some infectious disease, and has been known to follow typhoid fever, smallpox, scarlet fever, measles, and pertussis and allied infectious disorders. We must therefore assume that the infectious diseases are predisposing factors in the development of this disease.

Some authorities claim that noma frequently is a sequel to infectious diseases.

The process usually commences on the gums or the inner portion of the cheek, and spreads very rapidly to the adjacent tissues. Thus it is that it will destroy the inner portion of the cheek and spread to the outside, causing similar destruction to the healthy tissues. From the nature of the method of spreading it appears to be of a specific nature. Whether or not a specific micro-organism causes this disease has not yet been definitely determined. We know, however, that it commences similarly to a diphtheritic process and spreads in the same manner. Weak children, as those above mentioned, that have passed through severe infections, are the ones usually attacked with this disease.

*Symptoms.* The cheek will appear swollen, hard, and œdematous to the touch, the œdema causing such swelling that frequently the eye of the affected side cannot be opened. There is a decided fetor to the breath, which is often the first symptom noticed. The disease spreads very rapidly from the gums to the cheek. Frequently the teeth will loosen and fall out. The latter is frequently caused by the previous administration of mercury. Thus it is that great care should be used in giving mercury to children.

That it is not an inflammatory disease can be seen by the fact that the temperature is rarely or never above normal. The swelling can best be felt by opening the mouth and grasping the cheek between the thumb and forefinger. The skin over the induration is frequently mottled with purple spots resembling ecchymoses. The appetite is diminished, partly due to the fear of pain caused by chewing.

Some authorities state that children so affected have diarrhœa. Forchheimer believes that hemorrhages rarely occur, owing to the bloodvessels being filled with thrombi.

When this gangrenous mass discharges we will find a dirty, fetid saliva, with threads of broken-down tissue. The cervical glands in the immediate vicinity are always found enlarged. In severe cases it is not rare to have the parts ulcerate and even perforate the cheek after several days. When the disease extends inward, not only does periostitis occur, but necrosis of the jawbone has been noted. When the disease is as malignant as has just been described, then subnormal temperature, possibly delirium, may complicate the condition. The disease may extend to the lungs, causing a gangrenous infiltration. When the gangrene affects the genitals in girls, then a serious prognosis must be given.

Starr maintains that noma makes its appearance uniformly at one point on the cheek, and is unilateral, which suggests a localized causative lesion. The most natural theory, that of embolism of a large arterial branch, due to weakness of the cardiac muscle or increased coagulability of the blood—effects of the primary disease—is untenable, because, with the given conditions, emboli ought, at least occasionally, to be found in other positions, which does not happen. It is necessary to look rather to the nerves—namely, the trifacial, the facial, or the vasomotors. That the gangrene is due to a lesion of one of these seems to be borne out by experiments. Thus Magendie found that division of the trifacial in dogs caused destruction of the corresponding eyeball, and half of the tongue became dry, brown, and fissured, the gums spongy and hemorrhagic, and the teeth loose. "In animals tenacious of life—the batrachians, for example—the soft portions of the face are cast off in shreds, just as in spontaneous gangrene. After three or four weeks only one-half of the face remains."

A variety of bacteria can be found at the seat of lesion, but their presence has no etiological significance. The body of a child dead from noma has a gangrenous odor and decomposes quickly; the skin is shrivelled and the face and the feet are œdematous. The gangrenous parts are converted into a blackish-brown mass, and the maxillary bones are naked, brownish in color, and brittle. The nerves, when examined microscopically, are yellowish in color but unaltered in structure, and the bloodvessels are thickened and filled with thrombi. In the uninvolved parts of the cheek there is a dense exudation, while the palate, tongue, and tonsils are swollen and covered with black scales and crusts. The lungs are the seat of hemorrhagic infarctions, lobular or metastatic lobar pneumonia, and sometimes gangrene. The intestines are catarrhal. Evidences of the primary disease may also be present; for example, the lesions of typhoid fever or dysentery.

The following case will illustrate the condition described:

Elise G., aged seven years, was seen by me in January, 1900. The child had complained of severe headache for three or four days, and was very feverish. Her mother became alarmed because of persistent vomiting. She stated that the child vomited at least six times in twenty-four hours. She complained of feeling fatigued and had pains in her arms and legs.

Small doses of quinine were given the child, but did not seem to relieve the present condition.

The child was nursed for ten months, and was a strong baby up to this time; dentition commenced at the seventh month; the child's muscles and bones were well developed; there were no evidences of rickets; the first two years were passed without any sickness except an occasional attack of constipation. The child walked at the end of the first year and commenced talking at its fourteenth month. Twenty teeth—"milk teeth"—appeared at the end of two years. The child had measles in its third year, which left a bronchitis; the mother states that this same cough recurs every winter. The child has had whooping-cough, lasting four months, which was so violent that it had epistaxis almost every day for one month. This whooping-cough was so severe that, in addition to the nose-bleed, the child vomited almost continuously. From loss of sleep, in addition to the above-named symptoms, the child commenced to emaciate. This was at the end of her fifth year.

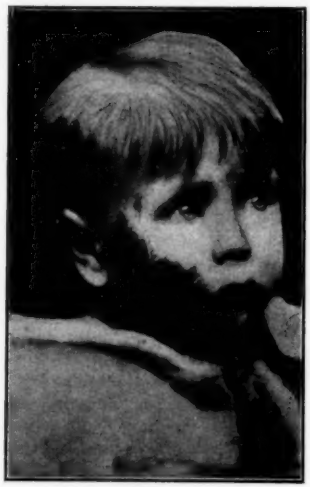
She lost twelve pounds in two months, and the mother states that since that time she has been very puny and delicate. There is also a hernia directly traceable to the violent paroxysms of cough.

The mother suspected the child was suffering from malaria, or possibly an attack of grip. When the child was undressed an eruption was found all over the body, which was that of typical scarlet fever. The throat was filled with evidences of pseudo-membranous patches which were distinctly scarlatinal in character. The temperature was 103.4° F., taken in the rectum; pulse, 128; respiration, 22. The child was put to bed and an expectant plan of treatment ordered, in addition to a very light liquid diet consisting of soup, milk, buttermilk, broth. Nothing else was allowed; no solids were given. For the thirst I ordered orange-juice and apple-sauce. Small doses (wineglasses) of citrate of magnesia were given for their laxative and diuretic effects.

Desquamation followed in the second week in the usual manner. The urine showed traces of albumin in the second week, which increased until that time—six pro mille, according to Eschbach's albuminometer—hyaline and epithelial casts were found in great numbers. There were also large quantities of blood-corpuscles visible under the microscope. The urine was quite red from the blood that it contained. At the end of the third week there was quite an anuria. This latter condition was relieved by the application of several dry-cups over the region of the kidneys. Five to ten grains of diuretin internally were ordered every four hours. Citrate of potash was given, five-grain doses combined with large quantities of apollinaris and lithia water. After three weeks of patient treatment the child recovered.

The heart sounds were not only very feeble, but thready, and a loud,

blowing, hæmic murmur was audible, which was attributed to the anæmic condition. Iron was given in the form of the syrup of iodide of iron; hypophosphites were also administered as restoratives. Convalescence lasted in all until April, a period of almost three months from the time of the child's first illness. About this time she complained of pain in the gums and on the cheek while chewing. Later, the foul breath attracted attention. At first this condition was attributed to the teeth, but a dentist who saw the child found the teeth and gums healthy. The ulceration, which had now become quite marked, from the size of a silver dollar, spread with remarkable rapidity. Its color was that of a dirty, blackish-gray, and had purpuric spots scattered around the edges of this ulceration, resembling subcutaneous hemorrhages. On examining it considerable fluid, which was very foul smelling, exuded on pressure. Antiseptic lotion, consisting of 50 per cent. peroxide of hydrogen diluted with water, was ordered as a mouth wash. The child was told to rinse the mouth every half-hour, especially after eating. The gangrene extended to the outside of the cheek, involving, as can be seen by the illustration, almost the whole cheek. The picture was taken after the child had had its mouth and its cheek thoroughly cauterized by using the Paquelin cautery. Ichthyol was applied in the following manner: ℞.—Ichthyol and lanolin. M. ft. ungt. S.—Apply over the whole of the gangrenous surface by rubbing the parts thoroughly, the same to be repeated at least three or four times a day. The ichthyol seemed to serve remarkably well in this case. The same was continued for about three weeks, when the child was discharged as cured.



A very instructive case is reported in the *Archiv für Kinderheilkunde*, 1898, p. 245, by Dr. A. Klautsch. Ranke was the first to report micro-organisms in this gangrenous mass; later Schimmelbusch reported a case of noma in the *Deutsche medicinische Wochenschrift*, 1889. This latter author found short rods with rounded edges, frequently in pairs, almost in pure culture, in the necrotic masses and in the necrotic tissue.

Cultures made on agar produced a growth of colonies which resembled porcelain. They also grew in large numbers on coagulated ascites fluid. The size and form of the bacilli depend on the nutrient medium on which they were planted. Their staining was rather difficult. When inoculated with necrotic tissue of pure cultures, rabbits, mice, pigeons, and chickens showed circumscribed necroses about the size of the above, which healed in about three days. In addition to the

above-named bacilli, Nicolaysen's investigations on two cases of noma showed that there are large masses of both bacilli and cocci present. The bacilli, while present in the necrotic tissue, frequently infected also the healthy parts. The cocci were found one centimetre distant from the necrotic tissue and in the lymph channels.

Cultures taken from the gangrenous and adjacent parts showed a coccus which was a non-pathogenic staphylococcus and a polymorphous non-pathogenic bacillus which resembled the diphtheria bacillus. Thus it appears that we are hardly in a position to state that there is a specific micro-organism which is a causative factor of noma. We are rather inclined to the belief that there are several bacteria causing this putrid process. The latter interferes with the nutriment of the parts, causing necrobiosis and consequent destruction of the tissue so invaded.

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## AN EXPERIMENTAL STUDY OF THE EFFECTS OF CHANGE OF COLOR UPON PIGMENT BACTERIA.[1]

By Charles A. Oliver, A.M., M.D.,
of Philadelphia.

As is well known, nearly all bacteria are devoid of color, appearing at most when colonized in pure cultures as whitish or yellowish-white masses. There are, however, a number of species which when massed exhibit marked, and, under certain conditions, very beautiful, though quite variable, coloration. These are known as the chromogenic or pigment bacteria, and are divided by Breyerinck and Schroeter into three groups: the "chromoparous," comprising those in which the

[1] Read before the Section on Ophthalmology of the College of Physicians of Philadelphia, at the December, 1901, meeting.

pigment-material consists of numerous color-granules surrounding a colorless germ-cell; the "chromophorous," those in which the protoplasmic matter of the cell is pigmented; and the "parachromatophorous," those in which the color-granules are situated in the cell-wall.

As Fischer says: "In all probability the coloring matter is of importance physiologically only where it is bound up with the protoplasm. In all the chromoparous bacteria the pigment is an excretion merely, and, as might have been expected, chemical and spectroscopic analyses fail to show that it has any connection with assimilation."

Since the special form of germ-material employed in the following experiments has been studied solely from a color-point of view (the author being well aware of its color behavior to differences of environment, etc.[1]) the use of a chromogenic basis of terminology is deemed justifiable in this contribution to the color department of ophthalmology.

It is a matter of common observation that some of the species of the genus chromatium of the colored forms (the so-called "purpurbakteria") of the sulphur micro-organisms give a reddish tinge to water, particularly during the spring and the autumn months. This tinting is found to be more pronounced in situations where the light-stimulus is the strongest. At first sight, this fact would lead to the belief that light is a necessity for such germs. The existence, however, of the main group of sulphur bacteria, for example, depends, as has been shown by Winogradsky, upon the intaking of sulphuretted hydrogen and oxygen; this particular form of thiobacteria possessing in such situations, through the agency of a color material (known as "bakteriopurpurin"), an additional power of assimilating carbonic acid for both energy-making and metabolism-product formation. Here the pigmented sulphur masses situated in the outer layers of the protoplasm of the bacterium are used for physiological purposes. These conditions are also true for the bacillus virens.

Other chromogenic bacteria, notably the bacillus violaceus, a species in which the pigment granules are generally found in the walls of the germ cell, lose their characteristic tint and become colorless should oxygen be taken from them.

The bacillus prodigiosus offers an excellent example of the chromoparous type of micro-organism. The red tint of its colonies is very pronounced, particularly if they appear upon such culture media as milk.

Being aware of the fact that many of the pigment bacteria colonizations become etiolated and changed in tint when the germs are removed from light stimuli, the author determined, as the result of the accidental

[1] The author has, in a measure, completed a number of studies upon the behavior of aggregations of aërobic and anaërobic bacteria toward fixed prismatic colors, the work being based upon Marshall Ward's classic experiments.

observation of a series of definite differences of coloration exhibited by two similar cultures grown under different color media, to make a number of experiments with the three types of chromogenic bacteria above mentioned. Some two years ago, in association with Dr. Napoleon B. Boston, bacteriologist to the Philadelphia Hospital, he commenced a methodical study of the effects of the interposition of transparent sheets of definitely gauged colored glass upon the coloration of germs that have received their designative names from their characteristic hues. A pure culture of every bacterium that was to be employed was obtained care being taken to select only those colonizations that had been grown under the optimal conditions for the particular micro-organism in question. Well-selected color-sheets of known ratios of pure red, pure green, pure blue, and pure yellow, chosen from definite primary tints in Radde's color-scale, were so arranged over specially contrived incubating boxes that the cultures used (kept at uniform temperatures) were uninterruptedly and yet coetaneously exposed to certain color-values for definite periods of time. Each species of germ experimented with was first studied and sketched after it had been grown in the dark and after it had been cultivated beneath an ordinary transparent area of clear glass. Some of the same germ material was grown separately in different media beneath the variously tinted sheets. Care was taken to avoid any loopholes of uncertainty and to see that the germ material was free from contamination. To be doubly certain of the results, fresh cultures in strange environments were studied with new apparatus and in conflicting and recurrent ways.[1]

In this brief communication[2] just sufficient of the work to be of interest to the ophthalmologist, *i. e.*, a few of the most striking of the color-changes noticed in the series of experiments, has been considered. This has been done with a desire to lessen the length of the article and to place enough of the data of the general findings that may be of interest to the practitioner in ophthalmology in a position where he

[1] The author desires to express his gratitude to Dr. Alexander C. Abbott for his many kind suggestions, and to Dr. Ella A. Hackett for most painstaking research work. He also wishes to thank Messrs. Wall & Ochs for careful selection of proper color-sheets, and Mr. Samuel T. Fox, of Queen & Co., for the loan of especially adapted physical apparatus and a set of Radde's International Color-scales.

To Mr. Frank B. A. Linton, Miss Alice B. Cruice, and Miss Mary A. Koonce credit must be given for exquisite art work, without which much that has been accomplished would have been irretrievably lost. To Coppen Jones' translation of Alfred Fischer's remarkably interesting and fascinating work "Vorlesungen über Bakterien," much of the enthusiasm that has constantly pursued the author during the latter part of the researches is due

[2] A paper bearing in a new and novel manner upon this subject was to have been read before the June, 1901, meeting of the Section of Ophthalmology of the American Medical Association, but on account of the author's inability to be present at the meeting it was withdrawn. It will, however, be reserved for incorporation in a more extended communication upon the general subject.

will be the more certain of finding them.[1] A system of color nomenclature that can be understood in any part of the civilized world has been consistently employed throughout all of the studies. These results, obtained in this manner, will give the reader an opportunity to have before him possibly some new and not uninteresting facts upon the still many moot points in the question of natural color, normal and subnormal color-perception, etc. At least the author hopes that the reader may have thus given him an inducement for further and more comprehensive study of the question which may be productive of observations which will be advantageous to himself and useful to the world.

A few of the most interesting results are as follows:

1. *Bacillus Prodigiosus.* This chromoparous species of germ grown on agar-agar in the dark gives a tint of carmine-zinnober which is represented in Radde's color-scale by letter h, plate 29, card 10. Grown on the same culture medium under a pure blue represented by letter h, plate 19, card 7 (Radde's color-scale), the growth assumes a purple-violet hue, shown by letter l, plate 24, card 8; while the borders appear carmine-gray in tint, as shown by letter m, plate 42, card 14. The germs grown on agar-agar under a pure red (letter m, plate 1, card 1, of Radde's scale) give a peculiar carmine-purple tint shown by letter d, in plate 27, on card 9 ( Radde); and at times the pigment massing becomes nearly colorless. A change of the culture medium to blood serum with the constant exposure of the germ to a pure green or cardinal tone, "grasgrün" (Radde, letter m, plate 13, card 5), has the effect of changing the colonization tint to a purple-violet, shown by letter i, plate 24, of card 8 of Radde.

2. *Bacillus Virens.* This beautiful sap-green species (shown by letter m, plate 14, card 5, in Radde's scale), like the sulphur-bacteria, has the pigment matter located in the protoplasm of the cell. Grown in the same situation and under similar conditions on agar-agar, under pure blue (see tint above), it, at times, becomes so greatly bleached that the germs assume a tint that falls to the letter u in the same plate on the same Radde card. Grown on blood serum and placed under the same pure blue, the characteristic naming tint of the germ disappears, it changing its hue to a light brown, as shown by letter s, plate 33, of Radde's card 11. Grown under red (*vide* tint above), on the same serum, it again becomes tinted deeply green, rising to letter f of plate 14, of Radde's fifth card.

[1] The author is arranging a series of papers upon the relative virulencies of the differently tinted colonies of the same bacterium; the seasonal, the altitudinal, and the climatic differences of coloration in the chromogenic forms of bacteria; and the selective color-points of greatest and least development, growth, and sporulation of paratrophic and metatrophic bacteria, etc.

3. *Micrococcus Rosans.* This little rose-colored sphere grown in the dark has its coloration degree indicated by letter m, plate 30, card 10 (carmine-zinnober), in Radde's color-scale. Grown on the same culture medium under pure red exposure (*vide* tint above), it quite frequently loses nearly all of its color characteristics, passing to q in the same plate of the Radde color series. The change made when the germ is grown on agar-agar under pure blue (*vide* tint above) is so slight at times as to be almost unnoticeable. Not infrequently, after the germ has grown on agar-agar under pure blue and pure green exposures, and even in the dark, it becomes deeper in tint than when it is grown under pure red.[1]

4. *Bacillus Indicans.* This short capsulated rod, which, as shown by Alvarez, produces indigo by fermentation with the glucoside indican, appearing in its characteristic tint when grown on agar-agar in the dark, becomes tinted to a delicate orange-zinnober hue (letter s, plate 3, card 1, of Radde) when it is grown on blood serum under a constant exposure to pure red.

5. *Bacillus Pyocyaneus.* The characteristic aggregation of this germ when grown in the dark is markedly changed when the micro-organism is placed in different media and is given varying color conditions. Two examples, both taken from blood serum cultures, illustrate this very well. Grown under the pure red of the series, the pigment becomes orange-yellow (letter m, plate 6, card 2, Radde) in tint; and grown under the pure blue of the series it fades to v of the same color-plate.

6. *Sarcina Lutea.* This greenish-golden species of the genus sarcina, with its curious bale-shaped colonies of cells, obtains its characteristic coloration (letter q, plate 8, card 3, Radde series) when it is grown in the dark, and bleaches to a light green-yellow (letter u, plate 9, card 3, Radde) when it is grown under the same conditions on blood serum. Similar though very delicate differences of color intensity, which are almost imperceptible at times, also manifest themselves when the germ is grown on agar-agar under pure red, pure blue, and pure green, these changes being even less noticeable when blood serum is used.

In addition to these series, which are of sufficient number to illustrate the points to be evolved in this communication, the author has made a great number of experiments upon the behavior of the bacillus janthinus,[2] pink yeast, the staphylococcus aureus, etc., obtaining not only both positive and negative color-changes, but other results which at first seemed irreconcilably curious and bizarre.

[1] These apparently diverse results were later accounted for by a study of the germ's foodstuffs. This study will be the subject of a further and more extended communication upon bacterial coloration.

[2] This germ gives the most remarkable difference of coloration when it is grown upon different media.

CONCLUSIONS. 1. Color-changes both of kind and of intensity take place in and around many chromogenic bacteria when such micro-organisms are placed under different color-conditions.

2. Rehabilitation of chromogenic bacteria into old color environments after having later obtained a new color-value under any particular color-condition, is quite frequently accompanied, sooner or later, with a return of the germ's color-equivalent to that which it primarily held while in its original situation.

3. Differences of color-conditions in pigment-bacteria most probably signify in part relative changes in the various methods of obtainance of sustenance, peculiarities in the kinds and the ratios of foodstuffs, and irregularities in the character of resulting excreta; each species of color-bacterium exhibiting its chromogenic change in a typical and relevant manner, a behavior that has its determining effect upon the very life of the germ itself.

4. The naming of bacteria by specific coloration is only of value when the actual habitat of the micro-organism is understood.

5. As a postulate conclusion based upon these facts, it is most certain that all living faunal and floral color-changes of true objective type are expressions of biochemical peculiarities taking place in and around such organisms—a mere difference of molecular motion as it were in part dependent upon the relationship existing between active life force and co-existing conditions.

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## ON THE EFFECT OF SEVERING AND OF MECHANICALLY IRRITATING THE VAGI.

BY GEORGE W. CRILE, M.D.,
OF CLEVELAND, OHIO.

PRELIMINARY REMARKS. In operations on the neck not infrequently the dissection is carried to the vagus, and occasionally, especially in a case of malignant disease, the question of removing a portion of this nerve or subjecting it to injury arises. In the literature of this subject the clinical reports of the effects of mechanically irritating, dividing, or resecting are much at variance.

REVIEW OF LITERATURE. Fontana resected a portion of the pneumogastric on twelve rabbits, three of which died.

Longet found that dogs usually survived this operation. He found that roughening of the voice followed and an increase in the frequency of respiration. There was emaciation and repeated vomiting, with diminution rather than increase of appetite.

Fano reported a case of the accidental resection of the right vagus

in a case of malignant disease adherent to the larynx. During the operation the patient was inclined to cough. In the evening after the operation nothing in particular was observed except that the voice was a little muffled. The following day there was difficulty in respiration and a cough. On the third day there was an increase in the cough and the voice had become more muffled. Five days after the operation there was chill, followed by fever and delirium. Respiration was normal. Upon auscultation no congestion of the lung was discovered. Coma succeeded the delirium; the pulse was full and frequent. During this time the dressings were torn from the wound, causing hemorrhage. Death occurred upon the sixth day. At the autopsy no metastatic abscess was found. Both lungs were a little engorged at the base and posteriorly. The stomach was of normal volume. The vagus on the right side had been removed in the course of the operation. The right hemisphere of the brain presented a vascularization more pronounced than the left. On the right side of the larynx there were some portions of the cancer that had not been removed. The exact cause of death is not stated.

Keppler reported the following case: H. K., a weaver, aged thirty years; diagnosis, sarcoma of the neck. Some difficulty was experienced in removing the tumor from its capsule, involving by extension considerable healthy tissue. Lying external to the common carotid artery a strand, about the thickness of the vagus nerve, whose position could not be ascertained owing to displacement of the parts as a result of the growth, was observed. This was carefully dissected away, and proved to be the obliterated jugular vein. After removal of the growth search was made for the vagus, which was found to have been severed. One hour after the operation the pulse was 112, regular; respiration, 36; temperature, 38° C. At 5 P.M., seven hours after the operation, the pulse was 128; respiration, 24. Eleven hours after the operation the pulse was 112; respiration, 30. The following day the pulse was 96; respiration, 24 to 26. Patient made a recovery without any untoward symptoms. Laryngoscopic examination showed epiglottis and arytenoepiglottidean folds to be slightly red, but free movement of the epiglottis returned four weeks after the operation. The pulse and respiration showed nothing anomalous.

Arthand and Butte severed the vagi in seven experiments, and report as a consequence there was increased respiratory action, followed by a return to normal condition.

Langendorff experimented on this subject, showing that severing one vagus caused long and deep respiration.

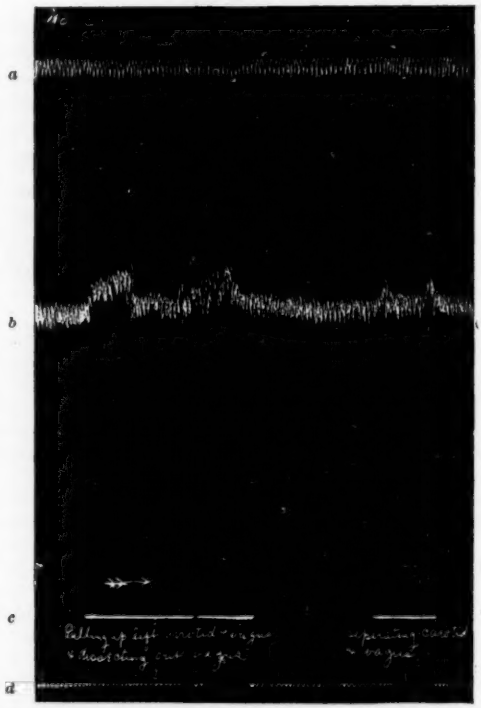
Cruenhogan claims that the section of one vagus either produces no change in respiratory movements, or, if so, the movement is but slightly lessened in frequency.

Widmer, in nineteen cases of one-sided vagus sections, states that in eight cases there was no change in respiratory movement; in one there

was a slight change; in another feeble respiration, and an increase in an already cyanotic condition.

Shevla found in a series of operations that the section of one vagus slows the respiration with deep inspiratory action, and that after several days respiration became more rapid until it reached its original frequency.

FIG. 1.



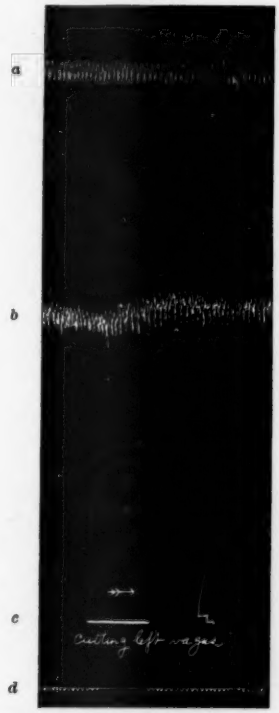

Vagal Experiment. *a*, respiration; *b*, blood-pressure; *c*, signal; *d*, seconds. Note the variation in the blood-pressure during raising and dissecting the vagus and the carotid. The second signal designates the dissection of the nerve from the artery. Note the irregular blood-pressure curve.

von Anrep, experimenting with warm-blooded animals, found that they could not withstand bilateral vagotomy. The animals died of pulmonary complications.

EXPERIMENTAL RESEARCH. *Protocols.* 1. *Vagal Experiment.* February 14, 1899. Cur dog; weight, twenty-six pounds; ether anæsthesia. While washing out the clot some magnesium sulphate solution ran into the carotid. The dog immediately had several convulsions. The blood-pressure dropped to the abscissa line and respira-

tion ceased. Artificial respiration was immediately instituted, and one-thirtieth grain of strychnine sulphate injected into the external jugular. After the lapse of a few minutes shallow respirations began, which gradually became stronger, the blood-pressure correspondingly rising. On manipulation of the left vagus there was a great temporary fall in the blood-pressure, followed by a slight rise.

FIG. 2.




Vagal Experiment. *a*, respiration; *b*, heart's action; *c*, time of experiment; *d*, seconds. Left vagus severed with a snip of sharp scissors. Note the slowed respiratory action and gradual rise in the blood-pressure.

2. *Vagal Experiment.* February 15, 1899. Canula in femoral artery. Brown cur dog; weight, twenty-seven pounds; ether anæsthesia. Pulling up and dissecting out of the left vagus and carotid caused a rise in blood-pressure with irregularity of the strokes (Fig. 1). Separating the vagus from the carotid caused a further slight rise in the blood-pressure and additional irregularity of the heart's action. On making traction of the left vagus respirations immediately slowed, the blood-pressure rose, and the strokes became irregular. On severing the left vagus the blood-pressure immediately rose, and respirations became slow. On severing the right vagus respirations became deep

and slow, showing quite an interval at the end of each expiration. The heart's action during this time was rapid and the blood-pressure became slightly elevated.

3. *Vagal Experiment.* February 16, 1899. Black cur dog; weight, eighteen pounds; ether anæsthesia. While separating the right carotid from the vagus by sharp dissection a slight rise in the blood-pressure was noticed. This dissection, together with other manipulation, caused a marked rise in the blood-pressure and slowing of the respiration. Severing the vagus caused a rise with no perceptible change in the respiration. The same experiment on the opposite vagus showed a like result as far as manipulation was concerned, but on severing the vagus the respirations immediately became slow.

4. *Vagal Experiment.* February 17, 1899. Yellow cur dog; weight, twenty-one pounds; ether anæsthesia. Canula in right carotid. Pulling and manipulating the right vagus caused an immediate rise in the blood-pressure and a slowing of the respiration. After one-half minute the blood-pressure returned to the point it occupied previous to the stimulation. After four minutes of manipulation of the carotid and vagus, similar to that produced by dissecting out a tumor, there was a slight rise in the blood-pressure, but no change in the respiration. On severing the left vagus there was an immediate gradual rise (Fig. 2) and a slowing of the respiration. Severing the right vagus caused an increased rapidity of the heart's action, producing a slight rise in the blood-pressure, with a slowing of respiration. There was a long pause at the end of each expiration.

5. *Vagal Experiment.* February 17, 1899. Mongrel dog; weight, twenty-six pounds; ether anæsthesia. Canula in right femoral artery. Dissecting the left vagus from the artery caused a slight fall in blood-pressure, but no change in respiration. Separating the right vagus from the carotid produced an immediate slight rise in blood-pressure. The experiment was made as nearly alike as possible on both sides. Severing the right vagus caused a rise in blood-pressure and a slowing of respiration. On severing the left vagus an additional rise in blood-pressure followed, and there was marked slowing of the respiration.

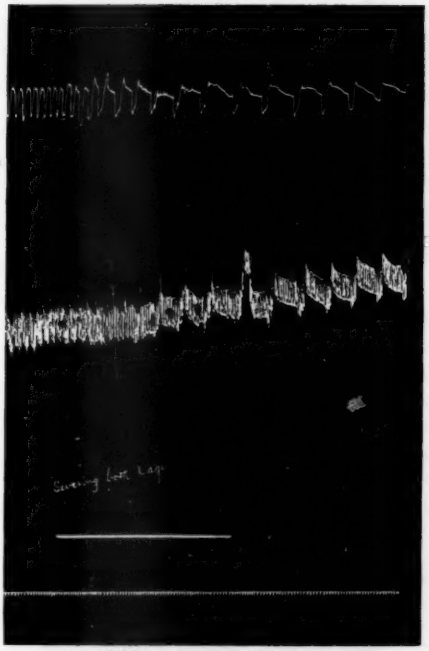
6. *Vagal Experiment.* February 18, 1899. Black mangy cur dog; weight, thirty-two pounds; ether anæsthesia. Canula in right carotid. Separating the right vagus from the carotid produced a rise in the blood-pressure. Both vagi severed by quick snips of a scissors. Respiration was much slowed and soon ceased. Heart-beats increased in frequency, and the blood-pressure gradually rose. (See Fig. 3.)

7. *Vagal Experiment.* February 18, 1899. Long-haired yellow mongrel dog, fair condition; weight, sixteen pounds; ether anæsthesia. Canula in right femoral. On pulling up the right carotid and vagus and roughly manipulating them there was a slight rise in the blood-pressure, which fell to the control as soon as manipulation ceased. The same was repeated several times with like result. On roughly manipulating the left vagus there was an immediate rise in the blood-pressure. (See Fig. 4.)

8. *Vagal Experiment.* February 20, 1899. Black mongrel, good condition; weight, twenty-two pounds; ether anæsthesia. Delicate manipulation of left side of neck caused a slight rise in the blood-pressure. Dog not entirely under anæsthetic. Repeating the same for about fifteen seconds again caused a slight rise. Applying vigorous

traction and rubbing the left vagus with artery forceps caused a marked irregular rise in blood-pressure, and a slowing of respiration, with a lengthening of the amplitude of the respiratory excursions. On cessation of manipulation the blood-pressure remained high, but the respiratory amplitude was lessened. Repeating the experiment caused an additional steady rise in the blood-pressure and a marked slowing of respiration. Upon a repetition of manipulation the pressure readily

FIG. 3.




Vagal Experiment. *a*, respiration; *b*, heart's action; *c*, time of experiment; *d*, seconds. Severing both vagi. Note the slowed respiration and the gradually rising blood-pressure. The respiratory effect upon the blood-pressure is well marked.

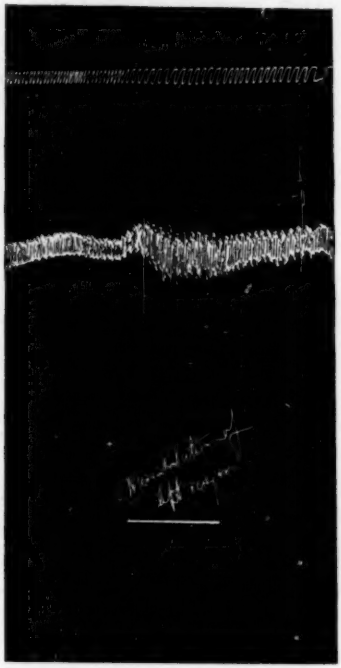
fell and the respiration remained slow. When the blood-pressure had reached the level of the control, the respiration improved, after which there was a slight rise. Roughly manipulating the right vagus caused a marked rise in the pressure, but not so marked as in the left. Respirations were not appreciably altered.

9. *Vagal Experiment.* February 20, 1899. Fox terrier, fair condition; weight, fourteen pounds; ether anæsthesia. On rubbing the left vagus between the thumb and finger an immediate rise in the blood-pressure occurred, and the respiration was much slowed. Dissecting out and vigorously rubbing the right vagus between the fingers caused a rise in the blood-pressure, but no alteration in the respiration. This

was repeated several times with like results. On roughly manipulating the trunk of the superior laryngeal, the blood-pressure fell to the abscissa line; the heart was reflexly paralyzed. (See Fig. 4.)

SUMMARY OF EXPERIMENTAL EVIDENCE. In the dog the sympathetic fibres run in a common trunk with the vagus proper. Therefore this nerve has been designated the vago-sympathetic, so that allowance must be made for the sympathetic factor. Picking up the artery and nerve together and bringing them up in the wound, making

FIG. 4.




Vagal Experiment. *a*, respiration; *b*, heart's action; *c*, time of experiment. Tracing showing the effect of mechanical nutation of the vagus. Note the slowed respiration during and following nutation, also the slowed heart-beat and irregular blood-pressure curve.

an ordinary blunt dissection and separating these structures from their surrounding tissues, produced slight effect upon the circulation and respiration. On separating the nerve from the artery by means of blunt dissection, comparatively slight effects were noted. Grasping the nerve with the forceps produced, in most instances, a rise in the blood-pressure and a slowing of the respiration. Dragging down upon the nerve produced a marked effect. Picking up the nerve and rubbing it

up and down, between the fingers, producing as much irritation as possible, caused a very distinct slowing of the respiration, and in most instances a rise in the blood-pressure. Occasionally, however, there was a temporary fall with a marked increase of the length of the heart strokes, indicating an inhibitory effect. In no instance was the heart completely inhibited. Grasping the nerve with two hemostatic forceps and so manipulating and irritating it, by sliding the forceps up and down, as to finally wear the nerve in two, produced in most instances a rise in the blood-pressure, and usually a very decided slowing in the respiration. Not only was the respiration slowed, but the amplitude was diminished. It required some time before the normal rapidity and amplitude were regained. No amount of mechanical irritation, even to the extent of mechanically destroying the vagi, produced an arrest of the heart's action. Severing one vagus was attended by comparatively little effect upon either respiration or circulation. Usually there was a slight rise in the blood-pressure, and a slight decrease in the frequency of respiration, with an increase in the amplitude. The blood-pressure curve remained regular, and no particular effect upon the amplitude of the excursion of the manometer was noted. However, on severing both vagi the blood-pressure rose considerably, ran an uneven course, the frequency of the heart's action was much increased and the length of the stroke shortened. Respirations were greatly decreased in frequency, and the amplitude of the respiratory excursion was markedly increased, so that, as nearly as could be estimated, the loss occasioned by the respiratory action was about counterbalanced by the increased amplitude of the excursion. The respiratory mechanism was much more affected than the circulatory and exhibited early signs of exhaustion.

CLINICAL. CASE I.—*Excision of right vagus, together with all the venous and arterial trunks on that side, in operation for malignant disease; respiratory failure after the operation; recovery.* John W., aged thirty years and eleven months, had had a very large median epithelioma of the lower lip removed. He returned to the hospital because of tumors on both sides of the neck; the glands were extensively involved; those on the left side were removed at a separate operation. The dissection was extensive, involving the removal of the external jugular vein, the external carotid artery, the submaxillary and parotid glands, exposure by close dissection of the common carotid artery, and the vagus nerve. Two weeks later the right side was operated upon. A chain of glands along the internal jugular vein was so extensively involved that on reaching this point it was found necessary to sacrifice both jugular veins, the common carotid artery, and its branches. The artery was separated from the vagus, but on carrying the dissection higher it was found that the vagus was so directly involved in the growth that it was necessary to sacrifice it. A consultant made a pulse-count both before and after severing the nerve. The heart became accelerated four beats per minute. No other effect was noted. Respirations were

not affected. A hypodermic injection of $\frac{1}{100}$ grain of atropine had been previously given. The dissection was then carried up behind the angle of the jaw, including the submaxillary and the parotid glands, the facial artery and nerve, and all the soft parts. The vagus was then severed just below the point at which the superior laryngeal is given off. This nerve and the lingual were laid bare in the dissection. The dissection was carried far behind the angle of the jaw, and the vessels were so deeply severed as to leave an insufficient length for applying a ligature. By means of a small curved needle, armed with silk, the deep structures around these vessels were picked up, forming a close purse-string, which, when tied, closed them. During the latter part of the operation the respirations were considerably slowed and the patient became somewhat cyanotic. The wound was then closed after completely arresting the hemorrhage. The sympathetic nerve was laid bare throughout most of its course, and the superior cervical ganglion lying upon the floor of the wound was wholly exposed. After closing the wound by bringing together as far as possible its deeper portions by means of catgut sutures the patient was sent to the ward. Directly afterward he was reported to be in a critical condition due to respiratory failure. Upon arriving at the bedside, I found the house surgeon maintaining artificial respiration. While observing the patient I noticed fresh blood on the dressings, indicating a dangerous hemorrhage. Hastily cutting away the dressings and laying open the wound, I thrust my hand into the upper angle from which the hemorrhage came. Although this was quickly done, there was a great loss of blood. With my hand grasping his throat he was replaced upon the ward ambulance and taken to the operating-room, the house surgeon maintaining, as well as he could, artificial respiration on the way. On returning to the operating-room the large vessels were clamped and the forceps allowed to remain. The patient was removed from the ward to the operating-room on account of want of light. Ice and heat were alternately applied, which helped to restore the respiratory action. He was given subcutaneous injections of saline solution and $\frac{1}{100}$ grain of strychnine every half-hour. At the end of twenty-four hours the forceps were removed, and at no time after recovery from immediate effects of the operation were there observed any unusual respiratory or circulatory symptoms. The patient made a good recovery. The microscopical examination of the growth showed a large number of inclusion cells, indicating a marked malignancy. There was considerable hoarseness for two weeks, after which it gradually disappeared. The respiratory failure in this case was in full accord with the experimental evidence.

CASE II.—(Abstract.) In removing glandular metastases following total laryngectomy, the left carotid artery and vagus were involved. The pulse and respirations were observed during the excision and after it. A hypodermic injection of $\frac{1}{100}$ of a grain of atropine was given twenty minutes before the operation was begun. The nerve was severed by a quick snip of the scissors. No effect upon the circulation or respiration was noted. Patient made a good recovery.

CASE III.—(Abstract.) In this patient the vagus was resected. One $\frac{1}{100}$ of a grain of atropine was administered prior to the operation. No immediate effects were noted.

CASE IV.—(Abstract.) A full charge from a shot-gun whose muzzle was within a few inches of the patient's neck when discharged, entered

the neck in the upper part of the carotid triangle. The artery was torn off and the nerve ulcerated. The wadding and shot were firmly packed upon and driven into the torn nerve and other structures of the neck. The pulse was reduced to forty-two beats per minute. Respirations were slow, exhibiting quickened respiratory action with lengthened pause and prolonged expiratory phase. The slow pulse continued more than two hours, after which the "vagal" mechanism went into resolution, and an extremely rapid cardiac action followed.

CASE V.—(Abstract.) In removing a mixed tumor of the parotid the dissection was carried for some distance upon the carotid and the vagus. While freeing the nerve near the level of the tip of the styloid process the pulse dropped from 90 to 56. The wound was almost bloodless, exhibiting the various structures in plain sight. A 4 per cent. solution of cocaine was applied upon a piece of cotton and the dissection carried elsewhere. After three minutes the dissection of the vagus was again resumed. Meanwhile, the pulse had returned to 86. During the remainder of the resection of the vagus there was no appreciable alteration in the heart's action, in spite of a more severe manipulation than had before been given. The depth of the tumor not having been anticipated, no atropine had been administered. This case illustrated the effect of stimulation of the upper portion of the vagus, notably near the point at which the superior laryngeal is given off. This nerve trunk, though not seen at the time, might have contributed to the cardiac phenomena from indirect violence.

CASE VI.—(Abstract.) *Emergency removal, without anæsthesia, of a large goitre during unconsciousness from asphyxia; vagus clamped; recovery.* Preliminary administration of one $\frac{1}{100}$ grain of atropine; inclusion of vagus nerve in large forceps; no cardiac inhibition; artificial respiration.

Female, aged sixty-four years; had had a goitre twelve years, which during the six months preceding the operation had rapidly developed. The tumor was large, quite firm, deeply situated in the neck, extending well down behind the sternum and clavicle, displacing the apex of the lung and producing a compression of the trachea against the vertebral column. The tumor was so firmly fixed as to be scarcely movable. During two months she had been obliged to make use of the extraordinary muscles of respiration. The development of the platysma was remarkable. In each inspiratory effort the contraction of the muscle was so powerful as to draw down the angles of the mouth, lower lip, and the integument of the lower part of her face, to throw into horizontal folds the entire surface of her neck and upper thorax, and to entirely change the aspect of the neck and face. The lower jaw, meanwhile, was carried fixedly forward and upward. By this means she was able to so slightly relieve the pressure upon the trachea as to accomplish a stridulous though scant exchange of air. It was planned to expose the tumor under local anæsthesia, then try to relieve the obstruction by elevating the tumor while administering general anæsthesia. She was placed upon the table, but was absolutely unable to breathe in a lying posture. She struggled for breath, sprang up into a sitting posture, then gasping, turned cyanotic, became unconscious, and fell apparently lifeless on the table. At a single stroke with a scalpel the tumor was laid bare, then literally torn out, while the blood from the many torn vessels flooded her face and neck. Artificial respiration was in the

meantime begun. The hemorrhage was first controlled by firm gauze packing, then with a large forceps the common carotid artery, jugular vein, and vagus nerve were grasped *en masse* below and likewise above, completely controlling the hemorrhage. The operation was performed in about forty-five seconds. The patient had been given $\frac{1}{100}$ grain of atropine previous to the operation, which prevented any cardiac inhibition, although the vagus was crushed at the point of clamping. The operation was completed without her knowledge. She said afterward that she believed she was dying and was conscious that something was done, but had no pain. Patient made a good recovery.

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## AN EXPERIMENTAL INVESTIGATION INTO THE CAUSES AND THE TREATMENT OF DIABETES MELLITUS.[1]

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In the years 1890 to 1892 Lépine, Arthus, Krauss, and others published a series of investigations on the self-destruction of the blood-sugar; they postulated the existence of a sugar-splitting (glycolytic) ferment, and formulated a number of more or less hypothetical views in regard to the rôle of this substance in the pathogenesis of diabetes.

Some of the experiments of these authors I have repeated and amplified.

### I. *The Sugar-destroying Action of the Blood.*

*Experimental Series 1.* 100 c.c. (3½ oz.) of blood were removed, under aseptic precautions, from the median vein of a healthy adult man, rapidly defibrinated, and allowed to stand in a sterile vessel at body temperature. Samples of this blood were removed at varying intervals, and the sugar determined by titration. The method employed was that of Röhmann, modified by Arthus[2] (it consists essentially in removing all of the albumin and titrating the sugar in the filtrates according to Fehling). The following table will show the progressive loss of sugar:

[1] Read, by invitation, before a meeting of the Section on General Medicine of the College of Physicians of Philadelphia, November 11, 1901.

[2] 20 c.c. of blood are poured into from 7 to 8 volumes of boiling water that is slightly acidulated with acetic acid filtered, the coagulate expressed, washed repeatedly with hot acidulated water, the filtrate and the washings concentrated to about 200 c.c., filtered again, freed from the last traces of albumin with sodium-acetate and chloride of iron; the coagulate filtered off, washed, washings and filtrate evaporated to about 150 c.c. and carefully neutralized. In this fluid the sugar is determined according to Fehling with a modification suggested by Causse, viz., the addition of 2.5 g. of potassium ferrocyanide for the purpose of keeping the cuprous oxide in solution; the disappearance of the blue color of the solution is the index.

| | |
|---|---|
| Blood immediately after removal from the vein at 38° C. | 0.179 per cent. |
| " ½ hour after removal | 0.177 " |
| " 1 hour after | 0.169 " |
| " 1½ hours after removal | 0.148 " |

The temperature at which the blood is kept seems to exercise a considerable influence on the intensity of the process; the temperature optimum is the temperature of the body; below 10° C. no glycolytic action is manifest; heating the blood to 60° C. destroys the power. The statement made by Lépine that the presence or absence of oxygen exercises an effect could not be verified; a series of experiments performed as above in an atmosphere of oxygen, nitrogen, hydrogen, and carbon dioxide revealed no appreciable differences.

The lymph, too, possesses glycolytic powers, as shown by the following:

*Experimental Series 2.* Lymph removed from the thoracic fistula of a dog under aseptic precautions, and allowed to stand in a sterile vessel as above, will gradually destroy its own sugar; the glycolytic power of the lymph is, however, considerably greater than that of the blood; the sugar destruction proceeds more rapidly and is more radical.

*Experimental Series 3.* If a stated quantity of blood or of lymph is allowed to flow, under aseptic precautions, into a sterile vessel containing a sterile sugar solution, and the sugar in the mixture is determined at varying intervals, it will be found that a considerable quantity of the sugar is destroyed; the lymph destroys more sugar than the blood in a given time; as much as 4 per cent. of sugar are lost after one hour and as much as 7 per cent. after two hours, with blood; 8 and 12 per cent. in the corresponding time, with lymph.

The conclusions from the experimental series 1, 2, and 3 are that the blood and the lymph incorporate an agent that can destroy sugar.

## II. *The Glycolytic Ferment.*

In order to determine the source and character of the sugar-destroying substance in the blood, the following experiments were undertaken:

*Experimental Series 4.* 250 c.c. (8½ oz.) of blood were defibrinated and centrifuged for two hours at the rate of about 2400 revolutions a minute.

(*a*) *The serum* was decanted and examined for its glycolytic power and for the amount of sugar it contained; it was found that the serum contained nearly all the blood sugar and possessed no glycolytic power whatever.

(*b*) *The corpuscles* were mixed with a volume of cold physiological salt solution equal to the amount of serum decanted; the mixture was centrifuged, and the process of decantation and centrifuging repeated a number of times; in this manner almost all traces of serum were removed. It was found that the blood-corpuscles that remained behind incorporated no sugar and possessed no glycolytic power.

(*c*) *The washings.* The first washing contained nearly all the serum that was adherent to the corpuscles, and consequently, some sugar and

albumin; it had also acquired some glycolytic power. The second washing contained only traces of sugar and albumin, but had considerable glycolytic power. The third washing finally contained no sugar, only a very small trace of albumin (probably some hæmoglobin that had been dissolved out of disintegrating red blood-corpuscles), but possessed a still greater glycolytic power. The washings after this were indifferent, still contained some albumin in traces, their glycolytic power decreased successively, and finally disappeared.

From the experiments of series 4 we draw the conclusion that the sugar-destroying agent of the blood is contained in the corpuscles and not in the serum; it is soluble in cold physiological salt solution, and is consequently unorganized and not dependent on the life of the cell; in other words, the glycolytic power of the blood is not a vital process, but a chemical one, and due to the action of a "ferment."

In order to determine whether the glycolytic ferment is bound to the white or the red blood cells, the following experiments were undertaken:

*Experimental Series 5.* Ligatures were placed around the jugular vein of a cow, about four inches apart, and the piece of vein between the two ligatures excised and suspended for twenty-four hours in a vertical position; in this manner contact of the blood-corpuscles with "vital" tissue was insured and the coagulation of the blood prevented; at the same time the corpuscles could follow the law of gravity and settle at the dependent portion of the vein; it was determined in the course of these experiments that it is possible to bring about a distinct separation of the red and the white corpuscles in this manner, the red ones naturally occupying a lower position than the white ones. By introducing an aspirating needle into the lowest portion of the vein red blood-corpuscles mixed with a little serum are obtained; a little higher up white corpuscles mixed with serum are aspirated, and near the top of the vein pure serum is drawn.

The serum and the white and the red blood-corpuscles were placed into separate portions of sterile sugar solutions of known titer, and allowed to stand in the incubator for twenty-four hours; it was found that the serum and the red blood-corpuscles possessed no glycolytic power, but that the white cells were capable of destroying a large proportion of the sugar.

It must be added that in all these experiments with sugar solutions every effort was made to insure absolute sterility; bacteriological examinations of all the specimens were made, and those samples that were found to contain any bacterial growth whatever (despite the precautions taken, including the addition of thymol to all the specimens) were considered not available, and thrown out.

*Experimental Series 6.* If blood is removed from the vein of an animal and allowed to flow into a sterile vessel, and kept at body temperature as in Experimental Series 1, and the sugar determined every ten minutes, it will be found that the decrease of sugar is almost *nil* for the first half hour; that the sugar destruction progresses more rapidly

during the second half-hour, still more rapidly during the third, and that after that time it gradually decreases. (See table.)

If stained blood specimens are made during the first to the fourth half-hour, it will be found that glycolytic action seems to begin as soon as the first degenerative changes are noticeable within the leucocytes, and to progress *pari passu* with the increasing degeneration.

*Experimental Series 7.* The finding chronicled above induced us to attempt a more rapid artificial degeneration of the white cells; this was brought about by the addition to the blood of certain chemotactic substances, viz., turpentine and powdered animal charcoal; the blood was also rapidly cooled by immersion of the vessel into ice-water immediately after removal from the vein, and then placed into the incubator, after mixing with the sugar solution as above; these procedures, in fact, caused a more rapid glycolytic action during the first half-hour, a maximum during the second half-hour, and a marked decrease again during the third half-hour. (See table.)

TABLE TO EXPERIMENTAL SERIES 6 AND 7.

| | *Blood alone.* | *With turpentine.* | *Charcoal.* | *Cooling.* |
|---|---|---|---|---|
| Blood on removal . . . | 0.164 | 0.171 | 0.169 | 0.170 |
| First half-hour . . . . | 0.160 | 0.158 | 0.150 | 0.151 |
| Second half-hour . . . | 0.148 | 0.148 | 0.142 | 0.140 |
| Third half-hour . . . . | 0.129 | 0.144 | 0.140 | 0.137 |
| Fourth half-hour . . . | 0.118 | ..... | 0.138 | 0.136 |

*Experimental Series 8.* In Experimental Series 4 we showed that the first decantation of physiological salt solution removed from the corpuscles that had been separated from the serum by centrifuging possessed a smaller glycolytic power than the second decantation, and that the third, fourth, and fifth decantations showed decreasing sugar-destroying powers.

If, after removal of the serum, the corpuscles are shaken with a few drops of turpentine, or are mixed with charcoal and shaken, or are rapidly cooled off, and are then extracted with physiological salt solution, it will be found that the first decantation possesses stronger glycolytic powers than the second, and that the second, third, fourth, and the remaining corpuscles possess none at all.

*Experimental Series 9.* If, after removal of the serum as above, the corpuscles are mixed with glass powder and rubbed into a fine pulp in a mortar until microscopically no formed elements can be discovered, and if the mass is then extracted with a physiological salt solution, it will be found that the glycolytic power is greater than in any of the extracts obtained in the other experiments.

The conclusions from the experimental series 5, 6, 7, 8, and 9 are that the glycolytic ferment of the blood is present in the white cells (whether in the leucocytes or the plaques is not determined) and degeneration of the white cells must occur before the ferment can develop its powers.

While examining the blood serum for its glycolytic power (with negative result, see above) a peculiar phenomenon was observed that has a bearing on the question discussed in the preceding paragraphs, and may be mentioned in this place. The serum contains all the blood

sugar in solution; after being allowed to stand in the incubator for half an hour it was found in some instances that not only had no sugar been lost, but that, on the contrary, an increase of sugar had occurred! This can only be explained by the fact that a certain amount of glycogen was present in the serum which became converted into dextrose, in this way increasing the titer for sugar. This fact must be taken into consideration when interpreting the small glycolytic power of the blood during the first half-hour after removal from the body of an animal; the process at that time is quite complicated, viz., new sugar is being formed from the glycogen, the disintegration of the white cells is slowly beginning, the ferment is being liberated and, by osmosis, is gradually diffusing through the fluid, finally causing the destruction of the sugar.

### III. *The Rôle of the Pancreas.*

According to Lépine, the glycolytic power of the blood is considerably reduced after removal of the pancreas; a number of investigators after him denied this. In order to clear up this uncertainty the following experiments were undertaken:

*Experimental Series 10.* The pancreas was removed from two large dogs; the animals received no nourishment until their death, which ensued sixty and sixty-eight hours after the operation; eight and twenty hours after removal of the pancreas 30 c.c. (about 102 oz.) of blood were removed from each animal and allowed to flow into a sterile vessel containing .3 mg. ($\frac{1}{200}$ gr.) of oxalate of sodium (in order to prevent the coagulation of the blood); the four specimens were placed in the incubator at body temperature; sugar determinations were performed immediately after removal of the blood from the vein and every half-hour thereafter for one hour and a half. (See table.)

TABLE TO EXPERIMENTAL SERIES 10.

| | *8 hours after operation.* | | *20 hours after operation.* | | *Normal dog. Compare table to Exp. Series 6 and 7.* |
|---|---|---|---|---|---|
| | *Dog* 1. | *Dog* 2. | *Dog* 1. | *Dog* 2. | |
| Blood at once . . | 0.321 | 0.336 | 0.347 | 0.354 | 0.164 |
| After ½ hour . . | 0.313 | 0.329 | 0.339 | ..... | 0.160 |
| After 1 hour . . | 0.304 | ..... | 0.331 | 0.340 | 0.148 |
| After 1½ hours . . | 0.297 | 0.312 | 0.326 | 0.331 | 0.129 |
| Percentile loss . . | 7.47 | 7.11 | 6.05 | 6.49 | 21.3 |
| Absolute loss . . | 24 ‰ | 24 ‰ | 21 ‰ | 23 ‰ | 35 ‰ |

It will be seen that the absolute loss of sugar as compared to the absolute loss in the blood of a normal dog (the pancreas of which was not removed) is only slightly smaller (viz., 21–24 *pro mille* as against 35 *pro mille*), but that the percentile loss is very much smaller (viz., 6.05–7.47 per cent. as against 21.3 per cent.). It is difficult to draw any definite conclusions from these figures in regard to the decrease of the sugar-destroying powers of the blood after removal of the pancreas; for it might be argued that, in view of the abnormally large quantities

of sugar found in the blood (see table) after removal of the pancreas, a decrease in the percentile loss would be self-evident, even though the sugar-destroying powers remain normal; that, in fact, the only criterion for a loss of glycolytic power would be a marked decrease in the absolute quantity of sugar destroyed. It is true that less sugar is absolutely destroyed after extirpation of the pancreas, according to our tables (about one-third less), but the difference seems too small to warrant far-reaching conclusions.

A second series of experiments carried out in a different manner, however, definitely decide this question.

*Experimental Series 11.*[1] The object of these experiments was to increase the quantity of blood-sugar in a dog whose pancreas was not removed and to study the percentile and the absolute loss of sugar under the same conditions and at the same intervals as in Experimental Series 10. For this purpose the ureters of a dog were occluded by temporary ligatures and 12 g. (3 dr.) of dextrose dissolved in 30 c.c. (1 oz.) of sterile water allowed to flow slowly into the right jugular vein. In this case (see table) it was found that the absolute loss of sugar was far greater than normal and the percentile loss approximately normal.

TABLE TO EXPERIMENTAL SERIES 11.

| | *Dog of Exp. Series* 11. | *Normal dog.* |
|---|---|---|
| Blood at once | 0.462 | 0.164 |
| After ½ hour | 0.431 | 0.160 |
| After 1 hour | 0.408 | 0.148 |
| After 1½ hours | 0.381 | 0.129 |
| Percentile loss | 17.6 | 21.3 |
| Absolute loss | 81 ‰ | 35 ‰ |

In comparing, therefore, the loss of sugar in two dogs whose blood-sugar is increased above normal—the one animal with a pancreas, the other without—it will be found that the former animal destroys a far greater quantity of sugar than the latter; in other words, we arrive at the conclusion from the Experimental Series 10 and 11 that the removal of the pancreas decreases the glycolytic power of the blood.

From the conclusions arrived at so far it seemed *à priori* probable that the pancreas was in some way concerned in the manufacture of the glycolytic ferment—a supposition that a number of investigators, notably Lépine, the father of the glycolytic ferment, had expressed. Many attempts have, in fact, been made to isolate such a substance from the pancreas, heretofore, however, without success.

The known ferments of the pancreas placed into sugar solutions do not possess the power of destroying it. I could determine that trypsin, amylopsin, steapsin, and a variety of preparations of pancreatin may

[1] In the animals treated in this series it was found that alcohol, oxybutyric, lactic, and diacetic acid and acetone were formed in the blood; a report on this interesting and significant finding is reserved for future publication.

remain in contact with sugar solutions of varying concentration for many months without causing any loss of sugar.

In the course of some experiments on the destructive metabolism of hæmoglobin the following discovery was made: It was found that a watery extract of liver pulp always contained considerable quantities of trypsin, and it occurred to me that possibly this ferment was concerned in the formation of bile-pigment from hæmoglobin within the liver. In order to determine this point an attempt was made to artificially create conditions *in vitro* as nearly similar as possible to those obtaining within the liver. For this purpose a few drops of a dilute trypsin solution (with all due precautions in regard to antisepsis) were added to a dilute solution of hæmoglobin containing a small quantity of dextrose or glycogen, and the mixture kept at room temperature for a week. At the end of this time the hæmoglobin was found to be destroyed, the liquid was colorless, and contained bile-acids, while bile-pigment was found in the sediment. At the same time it was discovered that if sugar was omitted from the mixture—in other words, if trypsin was simply added to a dilute solution of hæmoglobin alone—the destruction of hæmoglobin proceeded along altogether different channels, *i. e.*, neither bile-pigment nor bile-acids were generated.[1] The sugar, therefore, played an important rôle in this conversion. A determination of the sugar before and after showed that a considerable quantity of the sugar had been destroyed in the process; in other words, trypsin in the presence of hæmoglobin possesses glycolytic powers. Here, then, was found a glycolytic ferment of pancreatic origin.

If trypsin is the glycolytic ferment that we have been discussing, then it should also be present in the blood, and, basing on our previous conclusions, should be present in the leucocytes and liberated from them when they disintegrated; or, inversely, the glycolytic ferment of our previous discussions should possess the properties of trypsin.

Both these postulates I have found to be correct.

In order to determine the character of the glycolytic ferment of the blood and to prove or disprove its identity with trypsin it was necessary to manufacture, if possible, some of the substance from the blood. We saw that the glycolytic ferment is liberated only after the disintegration of the leucocytes, so that the task set, theoretically, was to procure large quantities of leucocytes from normal blood, to cause their disintegration, and then to extract the ferment. Practically such an undertaking is nearly impossible; we know of no adequate method of procuring large quantities of leucocytes from the blood, nor was it probable that after disintegration only the ferment we were looking for would go into

[1] The results of this investigation have been recently published. See "Some Experiments on the Formation of Bile Pigment," etc. Philadelphia Medical Journal, January 11 and 18, 1902.

solution. As a matter of fact, a variety of substances have been described in leucocytic extracts. In view of these difficulties we had to content ourselves with a determination of the properties in general of the salt-water *extract* described above.

For the purpose of comparison with trypsin this is sufficient, because in the case of this ferment we are confronted with like difficulties. No one, so far, has determined the chemical character of trypsin, nor has anyone in all probability ever manufactured pure trypsin. Its presence in different solutions and products is revealed to us merely from its manifestations; in other words, from its ferment action on stated substances under stated conditions.

The properties of trypsin that we are familiar with are briefly the following: In an alkaline medium it digests proteid in such a manner that certain well-characterized products of proteolysis are generated. Brought in contact with certain coagulable solutions it is capable of inducing coagulation. Injected into the veins of an animal it produces widespread congestions, and is said to cause the death of the animal by forming thromboses. Chemically, it gives several proteid reactions (see footnote on page 671), and it is precipitable by dilute acetic acid (Hammarsten). It is coagulated by absolute alcohol, but is again soluble in water or in physiological salt solution, even after having remained in contact with alcohol for many weeks. Finally, according to an investigation that I have recently published (*Philadelphia Medical Journal*, January 11 and 18, 1902), it is capable of decomposing hæmoglobin and forming from it bile-pigment and bile-acids, only, however, in the presence of dextrose or of glycogen, and at the same time of destroying some of the sugar.

The solution of the glycolytic ferment from the blood possesses these properties of trypsin; this is shown by the following experiments:

*Experimental Series 12.* If fibrin flakes are placed into the ferment solution, and the latter is slightly alkalinized and kept at 38° C. for forty-eight hours, it will be found that a partial solution of the fibrin flakes has occurred and that albumoses, peptone, etc., in small quantities can be discovered in the solution.

*Experimental Series 13.* If the leucocyte extract is brought in contact with coagulable liquids it produces coagulation; this fact had been determined previously by Schmidt, Lilienfeld, and others; the former and his pupils attribute this action to the presence of a substance they call the fibrin ferment,[1] the latter to nucleo-histon; both substances are

[1] Wright (Journ. Path. and Bact., June, 1893). "There does not at present exist any test of any kind, chemical or physiological, of the existence of such a substance as the fibrin ferment. We may, therefore, omit it from our catalogue of coagulative substances."

Halliburton and Brodie (Journ. of Physiol., vol. vii. p. 143). "Whether any relation exists between the fibrin ferment and . . . . nucleo-proteids is a matter that demands renewed research."

chemically more or less undefined, and have probably not been procured in a pure shape, so that it is uncertain what the active final principle is that causes coagulation.

*Experimental Series 14.* If a small quantity of the solution is injected into the veins of a dog it produces instant death in some cases; on post-mortem examination thromboses will be found (see below). This fact, too, had been established by others.

*Experimental Series 15.* In order to test the chemical properties of our ferment it seemed imperative to manufacture a product that was more pure than the extract employed above; for this purpose a method was employed identical to that used to obtain the purest preparation of trypsin known; the blood (instead of the pancreas) was allowed to stand for half an hour at room temperature, and then poured into absolute alcohol and allowed to remain in contact with alcohol for four weeks; the alcohol was then removed by filtration and expression, and the residue (a brick-red, amorphous powder) extracted with normal salt solution; in contradistinction to the extract described above, this extract was colorless, and contained no hæmoglobin whatever (spectroscopic examination was altogether negative); on evaporation only traces of a dry residue were obtained showing that very little substance goes into solution; at the same time this extract possessed all the properties of the other one, and gave the chemical reactions of trypsin.

*Experimental Series 16.* The extract described in the preceding experiment, mixed with a dilute solution of hæmoglobin containing about 0.6 per cent. of dextrose, destroyed the hæmoglobin in the course of four to ten days; the fluid became colorless and, at the same time, bile-acids and bile-pigment were formed.

*Experimental Series 17.* The extract of Experimental Series 15 placed into sugar solution possessed no glycolytic power. The presence of hæmoglobin (or other proteid?) was necessary. It is probable that the glycolytic power of the extract described in Experimental Series 4 was due to the presence of minute quantities of hæmoglobin in the solution.

*Experimental Series 18.* Trypsin is the only one of the soluble ferments of the human organism that is never found in the urine; pepsin, rennet, diastase, and ptyalin have all been discovered there under certain conditions; the glycolytic ferment, too, is normally absent from the urine. It is further known that the urine destroys the power of trypsin; urine added to the extract described above destroys its glycolytic power.

To summarize, therefore, the actions of solutions of trypsin and solutions of our glycolytic ferment, we can state that they both can digest fibrin in alkaline solutions; that they can coagulate certain coagulable solutions; that they can produce thrombosis; that they give certain proteid reactions; that they are precipitable by dilute acetic acid; that they are precipitable by alcohol; that they are soluble in water after contact with alcohol; that they can form bile-pigment and acids from hæmoglobin in the presence of small quantities of dextrose; that they lose this power if dextrose is not present; that they possess glycolytic power in the presence of hæmoglobin; that they lose this power in the absence of hæmoglobin; that they are rendered inactive by con-

tact with urine, so that neither is normally excreted in an active form via the kidneys.

The conclusions from the Experimental Series 12 to 18 are that the solutions of the glycolytic ferment and solutions of trypsin are, if not identical, so similar that they cannot be distinguished by known methods. Until proof to the contrary is forthcoming, we are justified in declaring the glycolytic ferment of the blood and tissues to be none other than trypsin[1].

## IV. *Pathogenesis.*

Diabetes is a symptom-complex, properly speaking, of a variety of pathological conditions. Glycosuria never occurs without hyperglycæmia; in other words, the sugar circulating in the blood must be increased considerably above normal before the kidneys excrete it. Hyperglycæmia may be due to an increased formation or assimilation of sugar, or to a decreased destruction, or to both.

In order to understand the pathology of a disease, it is necessary to understand the function or functions a perversion of which it represents. Normal sugar catabolism, the function perverted in diabetes, probably proceeds as follows:

Immaterial what the source of the sugar, whether it comes from the food or from the fats or proteids of the body, it is finally oxidized to carbon dioxide and water, and eliminated from the body in this form. The question arises (and applies with equal strength to the fats and the proteids), How can a substance that, outside of the body, requires very high degrees of temperature for its combustion be oxidized at a temperature not above 38° C.? The answer is given in the fermentative destruction of the sugar molecule by certain bacteria and other organized and unorganized ferments; as a preliminary step the sugar molecule must be split into simpler substances like alcohol or lactic acid that possess a greater affinity for oxygen than sugar. Even after these preliminary transformations the action of some oxygen-carrier must be brought into play in order to cause the union of these bodies with oxygen in the body.

We have demonstrated that a sugar-splitting substance, a or "the" glycolytic ferment, exists in the body. We have shown that it is present in the blood and the tissues, and that it is probably none other than trypsin. We have further elucidated the process by which sugar is destroyed, and have shown that it is by a process in the formation of bile-pigments and bile-acids that the disintegration of the sugar molecule can occur anywhere within the body where hæmoglobin is liberated in the presence of trypsin. A perversion of this glycolytic function

[1] Whether or not the solutions of trypsin and of the glycolytic ferment contain a *tertium quid* that is the real ferment, chemical analysis cannot determine. I have shown in another publication that as far as can be determined the purest trypsin is a "dentero-albumose."

must lead to hyperglycæmia and glycosuria; we are justified, therefore, in seeing one of the causes, if not the only cause, of diabetes in a reduction of glycolysis. The question is hereby moved one step backward: What are the causes that pervert glycolysis and reduce the sugar-destroying powers of the body?

It is hardly probable that a uniform cause for this perversion exists. In many cases we have no explanation that is based on facts, and however seductive the various hypotheses in regard to the rôle of certain functional nervous disorders, infections, auto-intoxications, etc., may be, we are not justified in accepting explanations that are merely evolved by *à priori* reasoning.

A few words, however, may not be amiss in regard to the rôle of the pancreas. We have seen what an important part trypsin plays in the destruction of the sugar under stated conditions; and we have shown, as far as that is possible, that trypsin is identical with the glycolytic ferment; no wonder, therefore, that removal of the pancreas causes the accumulation of sugar in the blood; if trypsin is absent, the destruction of hæmoglobin proceeds along abnormal channels, and no sugar is destroyed; consequently, it accumulates; in addition, the products of abnormal hæmoglobin catabolism (albumoses, etc.) must needs be harmful, and, circulating in the blood, produce many of the toxogenic symptoms of diabetes; they probably constitute protoplasmic poisons; finally, the accumulation of excessive quantities of sugar in the blood leads to a variety of perversions of metabolism that will be discussed at length in a monograph mentioned in a foot-note previously; it may be stated in this place that the generation of large quantities of acetone, diacetic acid, and of oxybutyric acid *may* be caused by the presence of abnormally large quantities of sugar alone.

The occasional occurrence of bronzed diabetes ("cirrhose pigmentaire") is suggestive, in view of the intimate connection we have shown to exist between the formation of bile-pigment and sugar catabolism.

In the present state of our knowledge we are not justified in assuming pancreatic disease in all cases of diabetes; it is possible that functional diseases of the organ may exist during life that leave no anatomical trace; but we do not know that this is the case. Recent discoveries by Opie, however, in regard to the frequent occurrence of degenerative changes in the islands of Langerhans of the pancreas, give a certain experimental fundament to such an hypothesis.

### V. *Therapeutic Suggestions.*

What we have learned from our experiments seems to point the way to a rational therapeusis of hyperglycæmia, and therewith of glycosuria, and of diabetes.

The indication is to increase glycolysis. To do this the glycolytic ferment must be supplied. We know that such a ferment is present in the chyle, the blood, in leucocyte extracts of different kinds; we know, further, that trypsin, under certain conditions, possesses glycolytic powers, and that, finally, there are unorganized glycolytic ferments in certain plants—*i. e.*, the glycolytic ferment of yeast (made by Buchner).

The following measures, therefore, promise some success:

1. The infusion of chyle or of blood from a healthy animal.
2. The injection of leucocyte extracts.
3. The injection of trypsin.
4. The injection of vegetable glycolytic ferments.

I wish to append, as a preliminary report, the results of the employment of some of these methods on animals that had been rendered diabetic by the extirpation of the pancreas.

*Experimental Series 19.* The pancreas was removed from two female dogs; the animals received no nourishment until their death. Twelve hours after the operation the first analysis of the urine was made, and every four hours thereafter; the urine was withdrawn by catheterization; the different specimens contained the following quantities of sugar:

TABLE TO EXPERIMENTAL SERIES 19.

| | *Bitch* 1. | *Bitch* 2. |
|---|---|---|
| 7 A.M. | 0.62 | 0.77 |
| 11 A.M. | 1.27 | 1.24 |
| 3 P.M. | 1.82 | 1.96 |
| 7 P.M. | 2.02 | 2.21 |

A progressive increase of the sugar excretion will be noted.

After the last determination of sugar about 20 c.c. (about 6 dr.) of lymph, removed under sterile precautions from the thoracic duct of a healthy bitch of approximately the same age as the dogs whose pancreas was removed, were allowed to flow into the jugular vein, and the excretion of sugar determined every hour thereafter. (These experiments on the two dogs were performed under identical conditions at different times; for clearness sake the results obtained are tabulated together.)

TABLE II. TO EXPERIMENTAL SERIES 19.

| | *Bitch* 1. | *Bitch* 2. |
|---|---|---|
| 8 P.M. | 1.97 | 2.14 |
| 9 P.M. | 1.64 | 1.70 |
| 10 P.M. | 0.34 | 0.40 |
| 11 P.M. | 0.82 | 1.13 |

It will be seen that a decrease of the sugar excretion occurred within an hour after the injection of the lymph; that it reached a still lower point two hours after the injection; reached its lowest point three hours after the injection, and then slowly increased again until it finally

reached a point as high as before the injection. One of the dogs died during the night; the other one survived nearly two days. No subjective signs of improvement in their condition could be observed during the period of decreased sugar excretion. Lépine performed a similar series of experiments and arrived at similar conclusions.

We interpret the peculiar variations in the sugar excretion as follows: The leucocytes of the lymph survived for a time in the blood-stream, and did not begin to degenerate to any appreciable extent for some time after the injection; this corresponds to their behavior outside of the organism when kept at body temperature; as a result, the glycolytic ferment was not liberated until the end of the first hour; at that time glycolytic action began, and continued for another hour; as the ferment was liberated it was again removed from the circulation, so that after three hours all the glycolytic ferment contained in the cells of the chyle injected had disappeared, and, no new ferment being formed, glycolysis was again reduced. Result: An increased excretion of sugar.

*Experimental Series 20.* A healthy dog was treated as in the above experiment; instead of injecting lymph, however, blood from a healthy animal was transfused. The comparative sugar excretion was as follows:

TABLE TO EXPERIMENTAL SERIES 19.

| | *Before transfusion.* | *After transfusion.* |
|---|---|---|
| First hour | 0.51 | 1.71 |
| Second hour | 1.07 | 1.57 |
| Third hour | 1.66 | 1.41 |
| Fourth hour | 1.91 | 1.87 |

It will be seen that similar fluctuations in the secretion of sugar occurred, though within narrower limits than in Experimental Series 19.

It was observed in the course of some of these and other experiments in which the pancreas was extirpated that in those animals that died from the operation prior to any other interference, and that developed symptoms of peritonitis or of sepsis (and there was a goodly number of such failures), a decrease in the initial great excretion of sugar occurred in several instances. V. Mehring, the discoverer of pancreatic diabetes, reports similar findings. We are inclined to the belief that in these cases the decrease of sugar was due, in part at least, to the phagocytosis that naturally occurred in the accidents mentioned and to the disintegration of leucocytes that resulted.

The following clinical case, moreover, that came to my notice almost has the value of an experiment:

P. E., aged forty-nine years, diabetic; average sugar excretion during one month, 2.11 per cent.; develops chill and sudden rise of temperature; lobar pneumonia of lower left lobe; sputum analysis reveals pneumobacillus; during the course of the disease, which terminated by

crisis in the night from the seventh to ninth day, a great reduction of the sugar excretion was observed; the average for the seven days was 0.61 per cent.; the lowest point, 0.39 per cent., was reached just prior to the crisis; it is uncertain whether the leucocytes played a rôle here, or whether the reduction of the sugar was due to a specific action of the pneumobacillus (the latter, it is stated, possesses glycolytic properties).

Similar observations are reported in the literature. It is my intention to study the effect of intercurrent infections on the course of experimental diabetes in order to clear up this question.

*Experimental Series 21.* After removal of the pancreas and determination of the sugar excretion as above, leucocyte extract—both the salt-water extract and the solution of precipitated blood—was injected into the jugular vein: one dog died suddenly while the fluid was still flowing into the vein, and another animal died twenty minutes after the operation. In the first case an embolism was found in the precentral artery, and a large thrombus in the crural vein; in the second dog a thrombus was seen in the first part of the femoral artery, and another one in one of the branches of the pulmonary artery of the left side; the blood removed from both dogs did not coagulate. The extracts, therefore, incorporated either the fibrin ferment or Lilienfeld's nucleo-histon, both chemically rather undefined substances; it has never, so far, been determined whether either of these bodies (?) possesses glycolytic powers —*i. e.*, whether they are identical with the glycolytic ferment or not.

The injection of vegetable ferments with glycolytic powers has so far not been attempted.

The injections with trypsin and their results will be published later; for the present it can be stated that injections of doses larger than a milligramme are attended with serious symptoms of intoxication, and generally lead to the death of the animal in a very short time from various causes; at the same time the extreme toxicity of trypsin proves its great power of altering the course of normal processes; the same applies to many of our most useful remedial agencies; it is possible that when the correct dosage of trypsin is found, this substance may prove of value in the treatment of diabetes; it must be remembered that the glycolytic ferment is present in very minute quantities only.

The disastrous results obtained in animal experiments with leucocyte extracts and with trypsin have necessarily debarred us so far from attempting any of these measures on human subjects. From our animal experiments, however, it seems rational to attempt the infusion of lymph and the transfusion of blood in diabetes.

# PRESENT METHODS OF TREATING URETERS SEVERED DURING ABDOMINAL OPERATIONS.

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The attempt to treat the ureter severed during abdominal operations is of relatively recent development. Indeed, until within the last few years the repair of injuries to these tubes was a sealed book, it being the general opinion that any injury demanded either a nephrectomy or at least a ligation of the lower end of the upper fragment. Thus, Herman Thompson,[1] of Odessa, writing as recently as eight years ago, advised nephrectomy as giving the only chance of recovery in any case in which the ureter was cut. The dangers, however, incident to the operation of nephrectomy caused abdominal surgeons much concern, and various methods have of late been proposed to avoid this mutilating operation. These procedures may be divided into three classes: First, anastomoses made with other viscera in the abdominal cavity, as into the bladder and bowel; second, reunion of the severed ends of the cut ureter or uretero-ureteral anastomosis; and, third, anastomosis with the external surface of the body, as upon the skin or into the vagina and urethra.

While injuries to the ureters are considered to be one of the rare accidents which occur during the course of abdominal operations, it is quite probable, as remarked by B. B. Davis,[2] that, if the truth were known, a percentage of deaths ascribed to shock and faulty anæsthetization would be found in reality to be cases in which ureteral injury was the actual cause of the fatality. Injuries to the ureter may arise during the performance of operations in various ways. They may be caused by the inclusion of the ureter by a ligature at some point in its course, or by cutting or tearing it in the enucleation of tumors or inflammatory masses. The most usual situation of the traumatism is in the bottom of the pelvis near the base of the broad ligaments. The success attained in the repair of these structures has enabled operators to conscientiously sacrifice them in the removal of malignant neoplastic growths, and has even emboldened some enthusiasts to advise the extirpation of the whole bladder in cases of either a primary malignancy of the bladder or a malignancy of this organ secondary to carcinoma primarily in the uterus. Early in the serious study of this question the bladder anastomosis appealed to many men as theoretically the

[1] Zeitschrift f. Geburtshülfe u. Gynäk., 1893.
[2] Journal of the American Medical Association, December 29, 1900.

proper method for the treatment of many of these cases. Hegar and also Paoli and Busachi[1] made various experimental anastomoses between the ureter and the bladder; and Bauman, in 1892, Novaro,[2] in 1893, and Penrose[3] and Krug,[4] in 1894, performed this operation upon human beings. The method here used was to pass a suture threaded at each end through the wall of the upper end of the ureter, the same having been slit for a short distance in order to prevent stricture. These needles are then passed into the bladder through a slit in its wall made at the point at which the anastomosis will produce the least amount of tension, and are then pushed through the wall, from within outward, a short distance from the edge of the bladder wound. Traction exerted by means of these sutures thus draws the ureteral end within the cavity of the bladder. The suture is then tied and the mucous membrane of the bladder above and below the ureter sutured with catgut, the connective tissue and peritoneal surfaces being closed after the manner of any ordinary bladder laceration. It is always to be remembered that the distal end of the ureter must be tied to prevent a backward flow of urine through the normal ureteral orifice, as this complication has been met with in a certain number of cases reported by Modlinsky[5] and also by Pozzi.[6] As to the indications for this form of operation, it will be found that quite a number of men advise the bladder implantation in all cases occurring below the pelvic brim, *i. e.*, where the distance from the point of injury to the bladder is not so great as to preclude the possibility of an anastomosis between them. Among this number may be mentioned Penrose, Baldy,[7] and Krug. Kelly,[8] on the other hand, while believing that the operation is a valuable one, thinks that it should not be allowed to invade the province of uretero-ureteral anastomosis. The last-mentioned operator would perform uretero-ureteral anastomosis in cases where both the severed ends of the ureter are easily accessible, when no obstruction is present between the lower end of the ureter and the bladder, and when there is no carcinomatous trouble necessitating the sacrifice of the lower portion. If, however, any of these complications were present he, too, would perform a uretero-cystostomy. One of the strongest advocates of uretero-cystostomy is Baldy, who has seen three cases in which this bladder anastomosis was employed, in every case

[1] Emmet. American Journal of Obstetrics, 1895.
[2] Centralblatt für Chirurgie, 1893, vol. xxvii.
[3] Penrose. University of Pennsylvania Medical Magazine, April, 1894.
[4] Krug. Journal of Obstetrics and Gynecology, 1894.
[5] Centralblatt für die Krankheiten des Harn-Sexual Organs, vol. v. 1894.
[6] Pozzi. Annales des Maladies des Organs Genito-Urinaires, 1891.
[7] Baldy. American Journal of Obstetrics, vol. xxxiii., 1896; and New York Journal of Gynecology and Obstetrics, November, 1894.
[8] Kelly. Bulletin of the Johns Hopkins Hospital, October, 1893, and February, 1895; Annals of Surgery, January, 1894; Journal of the American Medical Association, October 6, 1900.

with a satisfactory result. This operator claims that the limits of ureteral destruction, as set by some men, beyond which they do not advise the performance of the bladder anastomosis, are too narrow. He, with others, claims that this operation may be done with success at any point of the pelvic portion of the ureter. In his own case the ureter was cut above the iliopectineal line, but by passing a catgut stitch through the wall of the bladder, and thus attaching it to the stump of the ovarian artery, he was able to avoid tension on the ureteral stitches at the point of anastomosis. Kelly in a similar case of high ureteral injury dissected the bladder loose from its pubic attachments and dropped it back into the pelvis, thus producing an apparent lengthening of the ureter amply sufficient for the operation. Baldy calls attention to the fact that the majority of ureteral injuries occur in the lower portion, where most men are agreed that a uretero-ureteral anastomosis is a very difficult operation. He calls attention likewise to the apparent increase in ureteral length resulting from its dissection from beneath the peritoneum, by which its markedly curved course is converted into a straight line. The majority of those who have used the operation under discussion favor the technique of Van Hook,[1] or what may be called the free-hand method, in contradistinction to the method by the use of anastomosis forceps. This is the method which has been given above in brief. Kelly, however, at one time advised that Sanger's forceps, passed into the bladder by the urethra, and then through an incision in its wall, should be employed. The same author has more recently called attention to a ureteral guide, which he introduces into the bladder through a small incision in the wall and then passes out through the usual bladder incision. Upon the bar of this instrument thus passed the upper fragment of the ureter is threaded, and then is easily drawn into the bladder and the usual stitches applied. While this instrument does not have the objection of Dudley's forceps in that it is not passed by the urethra, it nevertheless necessitates the making of an extra incision in the bladder wall, which seems an unnecessary traumatism, since on the basis of the cases reported as done by the free-hand method the operation has not presented any marked difficulty. Among the objections urged against the operation of uretero-cystostomy there are some which bring interesting points into discussion. Thus Emmet[2] claims that the chance of infection in bladder anastomosis is greater than in the case of uretero-ureteral anastomosis, on the ground that in the former the normal orifice of the ureter is not preserved. Later studies have, however, shown that the so-called ureteral valve is probably non-existent, and that the real safeguard against infection is the presence of uninjured

[1] Journal of the American Medical Association, 1896.

[2] Loc. cit.

vesical mucous membrane. The absence of infection in the cases reported also offers strong evidence in support of this last-mentioned belief. As further evidence, it may be mentioned that in the experiments to be referred to later, in which the ureters were implanted in the bowel, it was found that the mere implantation of the ureteral orifices alone did not prevent infection, while if a portion of surrounding mucous membrane were transplanted uninjured with the ureteral orifice the chance of infection was greatly reduced. Bovée[1] is of the opinion that one of the possible dangers of the bladder implantation is that either a constriction of the ureter will be caused, with its resulting evils of slow hydronephrosis, or that a too free opening, with the absence of the valve, may permit a backward flow of urine, with the same result. These complications, however, have not, as far as our knowledge goes, been seen in practice, and theoretically it would seem unlikely that the tendency to stricture after uretero-cystostomy would be as great as in the case of either a uretero-ureteral anastomosis of the oblique, the end-to-end, or the end-in-end methods, since healing in all these takes place in a circular direction; while in the uretero-cystostomy, on the other hand, it occurs in an ellipse, and so may be considered comparable to the method of healing as observed in the end-in-side method of uretero-ureteral anastomosis. The backward flow of urine in any case of uretero-cystostomy, which is certainly even theoretically only problematical, will in practice be prevented by the high point in the bladder wall at which the anastomosis is made and by the use of the catheter at suitable intervals after the operation. It is, of course, true that the ureteral muscle-bundles running in the normal bladder from the ureteral orifice downward cannot be imitated by this operation, and likewise that the course of the anastomosed ureter is not oblique with reference to the muscular wall of the bladder, but perpendicular. While, however, these may be theoretical objections, they have not apparently given rise to any practical difficulties in the cases which have been reported as operated upon by this method.

The other method which has recently received the greatest amount of attention is the rejoining of the severed ureteral ends, or uretero-ureteral anastomosis. One of the chief drawbacks of this method of repair is the inherent difficulty of the operation, which Kelly[3] likens to the most difficult of those done upon the eye. The flaccidity of the walls and minuteness of structure of the ureter, as well as the depth at which most of these injuries occur, which necessitates that the repair be carried out in the bottom of the pelvis, have constrained Baldy[3] to urge that bladder anastomosis be done whenever practicable. Kelly[4] does not feel that these operations—*i. e.*, bladder anastomosis and

[1] Annals of Surgery, 1897.
[2] Loc. cit.
[3] Loc. cit.
[4] Loc. cit.

uretero-ureteral anastomosis—are to be considered as rivals, but thinks that there are indications for the employment of each. He would prefer to do a uretero-ureteral anastomosis when both ends are accessible, when no obstruction is present between the lower end and bladder, and when the lower end does not have to be sacrificed to meet the indication of malignancy. If the above conditions are not fulfilled he would do a uretero-cystostomy. Kelly[1] advocates the use of his ureteral guide, previously mentioned, as an aid to the peformance of the operation of uretero-ureteral anastomosis.

Different investigators have advocated different methods of uretero-ureteral anastomosis, and these may be grouped into four classes, as follows:

1. Lateral implantations, or the end-in-side method. Originated by Van Hook.
2. Transverse end-to-end approximation.
3. Oblique end-to-end approximation. Bovée's method.
4. End-in-end. Done by various experimenters, and once in a human case, the result in the latter being a success.

The dangers of these methods of anastomosis may be considered in the main to be those of urinary leakage, fistulæ, and constriction. These dangers are particularly threatening, as may be imagined, in the case of the end-to-end approximation—*i. e.*, without invagination—and the end-in-end, with invagination. Bovée's method has only been used once in a human being, and there has been no experimentation carried out in animals, so there is not enough evidence upon which to base a verdict. Van Hook's method, on the other hand, originated in 1893, as a development of the experimentation of Poggi,[2] published six years previously, seems, on the authority of his own animal experimentation and also upon that of others, to be free from these objections to a great extent. Kelly[3] was the first to use this method in a patient. His operation was performed in 1893, and Emmet[4] followed with the second case in 1894.

Bovée,[5] in 1897, was able to collect twelve cases of anastomosis of the divided ends of the ureter. Of these seven were done in Europe and five in America. Among these twelve cases three of the European cases died, but in no one of them could the death be attributed to the ureteral complication. The American cases all lived. In the series there was only one case which showed a leakage, and this soon ceased. But four of these twelve cases were drained, and the author is emphatically against the use of drainage for the ureteral injury *per se*, only advising it if pus be present. Three of the cases in the series reported

[1] Loc. cit.
[2] Riforma Medica, 1887.
[3] Loc. cit.
[4] Loc. cit.
[5] Loc. cit.

were done by Van Hook's method. All of these recovered, but no positive statement is to be found regarding the development or absence of constriction as a late result. One case done by Poggi's method—the end-in-end invagination—was a success. Seven of this series were end-to-end approximations; and, although three died, there was no leakage in any of the seven, and the deaths were not due to the ureteral condition, as far as can be ascertained. The author's case was the twelfth, and was performed by making an oblique end-to-end anastomosis. It was successful.

As to the actual method of performing the operation of uretero-ureteral anastomosis, it is, first of all, as Kelly insists, of importance to determine the presence of any anomalies, and also to find out whether the ureter is "alive," or, in other words, patulous. Kelly was able to collect five cases from the literature in which the ureter was so occluded by disease that no urine could pass, and the operation, of course, was not indicated. If on palpation the kidney be found atrophic or sclerotic the operation is useless. It may be noted that the soiling of the peritoneum by the escape of urine is an accident of no importance, provided the latter is normal; but as abnormalities may readily be present it is well to try to avoid the soiling of the peritoneum in all cases by the use of pads during the suturing. The use of Kelly's guide is self-explanatory, the transverse bar being introduced into the lower fragment through an incision, and passed out of the ureter through the upper end of the lower fragment and into the lower end of the upper fragment, which is then invaginated into the lower and the suture inserted. The use of this guide enables one to have the aid proposed by Pawlik without the disadvantages of the catheter. Pawlik advised the retention of the catheter to assist drainage, but this is not advisable. In Van Hook's method the lower end of the ureter is ligated, and an incision is made into the wall a quarter of an inch below the point tied. This incision should be twice as long as the diameter of the ureter. By the application of traction sutures the upper end of the ureter is then drawn within the incision and the sutures are applied.

Early in the study of this subject the possibility of intestinal anastomosis presented itself to investigators. As early as 1851 it was performed in a case of exstrophy of the bladder by Simon, upon the suggestion of Roux. This case died in a year with marked kidney changes. Chaput and Leet were more successful, the former having one and the latter two cases which recovered. It is very easy to understand the desire of investigators to prove the applicability of intestinal anastomosis, as if feasible the operation would be much easier of accomplishment than uretero-ureteral anastomosis, on account of the size of the tube into which the ureter is introduced, and also because there would be a complete avoidance of the dangerous traction, which has been

one of the causes of many of the failures of the latter method of operation.

Notwithstanding the encouragement met by some investigators in this field, there seems to be one factor which is insurmountable, namely, the ascending infection, which involves the vast majority of all ureters thus anastomosed. Aside from this difficulty, there seems little reason why the intestines should not be thus utilized, as it has been found, as mentioned by Peterson,[1] that the large bowel in the dog can assume the functions of a urinary reservoir, and that sphincteric control will be maintained. It is to be noted also that while it seems to be the current belief that the mere presence of the urine in the intestines will cause a diarrhœa, there does not seem to be a unanimity in this opinion among many of the men who have had experience in both the human and the experimental cases in which this form of operation has been done. Thus Martin[2] expresses himself as not in accord with the view that urinary absorption is a great danger, and in quite a number of experimental and also of human cases it will be found that nothing more than a rather increased frequency in evacuations was caused, and that the incontinence of the bowels, so much feared by many, has not, as a rule, been observed.

Unfortunately, however, the question of the liability of ascending infection is one which no one as yet has been able to surmount. By this, of course, is not meant that no case has ever recovered from such an operation and lived for a long period, but that the percentage of cases exhibiting this form of infection is so high that the operation cannot be at present considered as justifiable. Of all the papers published on this subject, that by Peterson[3] is the most thorough. The author is rather enthusiastic on the results of his method, which is a modification of Maydl's operation, by which the trigone is transplanted as a whole, thus avoiding any injury to the ureteral orifices, a point upon which Tuffier first insisted, with the idea that infection was prevented by the presence of the supposed ureteral valves. Later investigation seems to show, however, that, as is claimed by Peterson and others, the ureteral muscle in its sphincteric action has no preventive power as regards the ascending infection, and that there is no demonstrable valve at the ureteral orifices; but that the mucous membrane in the immediate vicinity of the orifices has the selective power. Peterson places the mortality of experimental intestinal implantations of the ureter as 61 per cent. in the case of the unilateral and 85 per cent. in the bilateral, and was unable to find a case in which kidney

[1] American Gynecological and Obstetrical Journal, 1900.
[2] Journal of the American Medical Association, January 28, 1899.
[3] Ibid., February 16, 1901.

involvement did not occur sooner or later. The deaths in Peterson's series were due to peritonitis from giving way of the stitches or from uræmia. He collected a series of thirty-three operations by different men in human beings, and found a primary mortality of 33 per cent., with a final mortality still higher. He is able to show one case of unilateral implantation living after eight years, and one of double implantation alive and well after three and a half years. Of the twenty-two cases recovering from the immediate operation there were three subsequent deaths from pyelonephritis and two from uræmia. The author says he is unwilling to call any operation a success which will not bear the test of the double implantation. The above statistics apply to what the author calls the simple anastomosis—*i. e.*, an anastomosis in which the ureters were cut and the free ends inserted into the bowel. In forming his conclusions on the subject, Peterson made three series of experiments. The first of these comprises twenty-eight bilateral anastomoses, without preservation of the trigone. Of these dogs twenty-three died and five recovered, and among these recoveries there was no case which did not show gross lesions of kidney infection. In but one of the five, indeed, was the ureter not patent; but in four there was a distinct enlargement of the lumen, showing that a constriction was present. One of the most interesting facts brought out by this paper is that in one of the five recoveries it was found that the kidneys had been able to overcome the infection, and that they were sterile. The same was true in another of the five cases, in which instance the kidney was at the time of the examination recovering from a pyelonephritis, thus showing that immunity to the colon bacillus was being established. Of course, the cost of the development of such immunity was the production of contracted kidneys.

The second series of experiments comprised sixteen lateral ureterointestinal anastomoses. Of this number there were but three recoveries. Twelve died from peritonitis because of leakage through stitch holes, and one from hemorrhage. The three recoveries were simply operative, as death followed in all after a short time from kidney infection and pyæmia.

His third group of experiments are those devoted to the implantation in the intestinal wall of the trigone of the bladder, and, while the results obtained are not particularly good, he explains a considerable number of the failures of his earlier operations as due to the fact that, inadvertently, the blood-supply of the trigonal area was destroyed, he believing that it was obtained from the ureteral arteries instead of the superior vesicals, as is really the case. This fault in technique he claims as the cause of the deaths in twelve of the cases of the series. He performed the experimental operation in twenty-one dogs, and reports the results as follows: Twelve deaths from peritonitis, due to

sloughing of the bladder-flap; four from peritonitis, due to other causes; and five recoveries. Of these five cases there was one which showed an occlusion of the ureter, with atrophy of the kidney, caused by poor technique; one showed a kidney free from infection on the side upon which a trigonal implantation had been done, while the other kidney, the ureter of which had been cut and simply anastomosed with the bowel, was the seat of an infection; another of the five died in forty-four days of pyelonephritis, but in this case, while the trigone had been transplanted, it is to be noted that the mucous membrane had been removed from around the ureteral orifices. The fourth case showed a similar result with the one just reported, though the process was more rapid, there being found after its death on the eighth day a pyelonephritis on the side upon which a simple anastomosis had been done, while on the other side, which had been the seat of a uretero-trigono-intestinal anastomosis, the kidney was free from infection. The last case of the series lived for a period of two months without signs of kidney involvement. The author, as the result of his studies, claims that the operation of uretero-trigono-intestinal anastomosis, while admittedly very serious, is justifiable in cases in which the only alternative is removal of the kidney after ureteral injury, or in which malignant disease demands the removal of a large portion of the bladder. He feels that the ordinary operation of anastomosis is not justifiable, on account of the great preponderance of the cases in which infection follows, and, moreover, because of the difficulty, which he regards as insurmountable, of anastomosing without causing more or less constriction of the ureter, the bad results of which in the production of cystic disease of the kidney are self-evident.

Martin,[1] in a paper advocating the removal of the bladder in cases of malignant disease of that viscus or of the uterus involving it secondarily, admits that the main difficulty is not in the removal of the bladder, *per se*, but in the after-disposition of the ureters. He advises that they be anastomosed, by Maydl's operation, to the bowel because of the reservoir space and sphincteric control which is obtained. He admits the grave dangers of subsequent infection, but is able to collect a series of sixty-two cases in which there were forty-eight recoveries. Of these recoveries thirty-three were done according to the method of Maydl, which is an additional proof of the claims made by Peterson. Unfortunately, however, this operation cannot be done if the whole bladder is sacrificed, and the author in such cases advises that the ureters be anastomosed in such a manner that they will enter the bowel in a direction from above downward, and that they be buried in the musculature of the wall for an inch or more. This is, in essentials,

[1] American Gynecological and Obstetrical Journal, May, 1900.

the position advanced at one time by Tuffier, but other experimenters, among them Peterson, have not found that the actual results obtained will support this claim.

Kalabin[1] made a series of experiments as to the feasibility of rectal implantation, but his results simply accentuate those obtained by the investigators already quoted in showing the dangers of the operation, particularly the simple form. His series was a short one, only comprising four operations. Of these dogs three died, two from peritonitis and one from uræmia. The fourth lived for a year, and was then killed for the purposes of his paper. There had been an entire absence of symptoms, and the post-mortem showed an entirely normal condition of the intestinal and ureteral mucous membrane. The kidney of the side upon which the transplantation had been done showed, however, a somewhat extensive change of a cirrhotic nature.

Barbat[2] has favored a rather unique method of anastomosis. His plan is to isolate a piece of intestine long enough to reach to the bladder from the proximal end of the ureter. This piece of gut is carefully cleansed, a solution of formalin (1 to 1000) being used for the purpose, and after the ureter has been introduced the other end is inserted into the bladder. In the case of a double anastomosis being demanded he would isolate a loop of gut long enough to permit its point of greatest curvature to reach down to the bladder, and would anastomose the ureters to its ends. Great care should, of course, be exercised not to injure the mesentery. There seems absolutely no use for this procedure, in our opinion, since it demands for its performance the presence of the bladder, and adds to the always formidable anastomotic operation the dangers incident to a resection of the gut. Moreover, it does not seem possible that the dangers of infection from the bowel can be obviated by the formalin sterilization. That the author is enabled to report two successful cases in a series of three operations upon dogs speaks well for his skill and for the recuperative powers of the animals, but we fail to see that there are any other deductions possible.

It is plain, therefore, from this hurried review of the subject of uretero-intestinal anastomosis, that the difficulty is one of infection of the ureters and kidneys, and to a less extent the causation of a certain amount of constriction leading to kidney enlargement. It may further be accepted that the simple anastomosis of the ureters to the intestines is not a permissible operation, as if an immediately fatal result is avoided there will be certainly a gradual kidney involvement, sooner or later manifest. The operation as proposed by Maydl, and

[1] Centralblatt für Chirurgie, December 23, 1899.
[2] Journal of the American Medical Association, August 3, 1901.

elaborated experimentally by Peterson, may in the future give better results; but at present, while his results seem more favorable than those of any other experimenter, they are not sufficiently encouraging to render their adoption justifiable in the human patient. There seems to be a certain amount of evidence to show that some cases may develop an immunity to infection, as in some of the human cases of anastomosis reported there was history of back pains, gradually disappearing; and among the experiments of some of the authors mentioned cases were noted at autopsy in which there was found a condition of contracted kidneys, and also in one case of Peterson's the dog's kidneys were found to be recovering from a pyelonephritis. Moreover, it is a well-known fact that the ureteral orifices, which in cases of exstrophy of the bladder are often liable to the contact of septic material, because of faulty care in diapering, sometimes resist infection for long periods. Reasoning from analogy, there seems some evidence also, as it is a well-known fact that in birds the urine and feces are deposited in a common receptacle or cloaca. This bird analogy has been advanced by Martin, among others, in support of his position, and he assumes that the production of this immunity to kidney infection may not be a matter of hereditary cycles, but that by improved methods of operating and after-treatment we may in the future be able to surmount the dangers of ureteral infection as we have already done in respect to infection of the peritoneal cavity. Van Hook, on the other hand, denies the applicability of the bird analogy, taking the ground that heredity plays an essential part in the production of such immunity, and, moreover, because of the difference between the character of the excrement voided by birds and that voided by human beings, the urine of the former being much less liquid than is the case with man, and therefore not as likely to carry an infection upward. Of course, arguments by analogy are rather dangerous until all of the facts of the case are in our possession; but it certainly seems a very questionable procedure to admit, as an operation of election, the anastomosis of the delicate ureter—perhaps the most carefully guarded excretory duct in the human economy—into an excretory system which, without exception, is always actively septic.

With regard to the remaining sites of ureteral implantation but little need be said, as from a practical stand-point none is of sufficient value to make its detailed consideration worth while. Though Bovée considered skin implantation about on a par with that into the bowel, and Martin has reported two cases of implantation upon the surface of the body, other men have determined that from the stand-point of infection it is even less trustworthy. Aside from this, the fact that a patient is debarred from all social duties, and becomes personally disgusting, would be sufficient to exclude this procedure from the list of legitimate

operations. The propositions of Van Hook, Nussbaum, and Rydygier, to connect the severed ends of the ureter by implanting each in the skin, and then, by plastic operations, to construct in various ways a channel between these ends, are, while interesting as experiments, of no value practically, as either bladder, uretero-ureteral, or bowel anastomosis are far preferable. Kelly considers skin implantation in the same class with nephrectomy.[1]

The vagina as a site for ureteral implantation has the advantage of reservoir space, but this is the only possible advantage which it possesses, although Bovée has considered it to be preferable to the bowel, and, indeed, places it immediately after the method of anastomosis with the bladder. He considers that uretero-ureteral anastomosis is the best method of all. It is to be remembered that he considered the simple bowel implantation only, and not the trigonal implantation, which had not at that time been brought to the attention of the profession by Peterson.

Among the curiosities of the subject is the case reported by Boari[2] (case operated on by Nichaus), in which an anastomosis was made between the ureter and the urethra. This man recovered from the operation. Adolfo and Schwarz report anastomoses made in animals between the same structures, in which after a time a new bladder was formed from the urethra, and continence maintained by the development of a vesical sphincter from its muscle. Finally, there are two methods of dealing with a severed ureter to which consideration should be given, in order, in the one case, to unreservedly condemn, and in the other to advise the limitation of its application to the case alone in which the condition of the patient is so precarious that there is no time for a formal operation of anastomosis. The procedure to be condemned is nephrectomy, done first by Simon, in 1871, to meet the indications of ureteral fistulæ. While formerly there was an excuse for recourse to this operation, at the present time none can be offered. The other procedure is the aseptic ligature of the severed ureter—an operation hardly less dangerous than nephrectomy, and whose only claim for recognition rests upon the fact of the short time necessary for its performance. It is, of course, of paramount importance to be very careful that the ligation be done under the most rigid aseptic precautions, as otherwise a pyonephritis or peritonitis may result. As soon after ligature as the extravascular urinary pressure equals the intravascular blood-pressure

[1] Of interest but of no practical application to this question are the researches of Rosenberg and Bardenheuer on the subject of the metamorphosis of the epithelium of transplanted mucous membranes, upon which Van Hook based his supposition that the skin surface used as a link would finally exhibit the characteristics of the ureteral membrane.

[2] Annales de Maladies des Organes Genito-Urinaires, vol. xiv., Paris, 1896.

the function of the organ will be abolished, and atrophy of the kidney will in the majority of cases follow. The organ at first enlarges; but if the ligature has been well applied, thus insuring a sudden cessation of excretion, there will be, according to Orth, but little sacculation. Indeed, the danger of hydronephrosis is less in the case of complete ligature of the ureter than in many cases of uretero-ureteral and other forms of anastomosis. Guyon, who advised the use of the ligature in cases demanding speed, supports this claim, as do also Cohnheim, Straus, Albarran, Germont, and Byron Robinson. Wladimiroff,[1] however, while finding his results, as a rule, in accord with those of the investigators just mentioned, reports two cases of pyonephrosis in a series of nineteen ligations. Of course, this may be looked upon as due to some failure in technique; but notwithstanding the rather favorable results as reported by some men on the basis of animal experimentation, the operation should be considered as only applicable to the few cases in which the time element is of paramount importance.

In addition to the references given in the article the papers by the following authors have aided in the compilation of this review:

Reynolds. Boston Medical and Surgical Journal, January 24, 1901.
Schopf. Allgemein Wiener medicinische Zeitung, 1886, No. 31.
Cushing. Annals of Gynecology and Pediatry, February, 1893, vol. vi.
Bloodgood. Johns Hopkins Hospital Bulletin, 1893, vol. iv. p. 89.
Reed. Journal of the American Medical Association, 1895.
Smith. Philadelphia Medical Journal, October 19, 1901.

[1] Zeitschrift für Geburtshülfe und Gynäkologie, 1893.

# REVIEWS.

A Text-book on Diseases of the Ear, Nose, and Throat. By Charles H. Burnett, M.D., E. Fletcher Ingals, M.D., and James E. Newcomb, M.D. Philadelphia and London: J. B. Lippincott Co., 1901.

In the preface of this book the statement is made that the close relation between diseases of the ear, nose, and throat renders it desirable that there should be a conjoint text-book on those diseases and their treatment. The project is not a new one, as most of the text-books on the ear also contain sections dealing with the relation of diseases of the nose and throat to that organ. So far, however, as we know this is the first endeavor to present a book written by three acknowledged authorities on the different topics under discussion and treating each of those topics as of equal importance with the others. The aim is a commendable one, and its execution has been admirably achieved. The trio of authors are all distinguished in the special lines whereof they treat, and each section of the work may be regarded as an exposition of the views of an authority in that branch. The only way in which such a book can be correctly considered is to take the different sections and consider them as distinct entities, each one constituting a small text-book in itself.

The section on diseases of the ear is written with a very exceptional lucidity and conciseness; matters of importance are emphasized and non-essential details are eliminated. Care is taken to emphasize the dangers attached to the use of certain measures which are very apt to prove misleading to those who do not make a special study of the science of otology. Thus the danger of recklessly incising furuncles in the external auditory canal, thereby providing a lodgement for growths of staphylococci, the dangers attendant upon the use of phono massage and vibratory massage, both of which are capable of producing a kind of boilermaker's-deafness, and the results which may follow attempts at the removal of foreign bodies from the ear, are all pointed out. The indications for the mastoid operation are considered, and the proper operation to be performed for each condition is described. Possibly one might ask for a fuller description of the various operations upon the mastoid with the different technique followed in each; but as this is readily obtainable in the larger works upon the ear and, after all, is of rather minor importance, such elaboration is not seriously missed. Some years ago Dr. Burnett substituted the removal of the incus for progressive deafness, in lieu of removal of the entire membrane and ossicular chain. The operation has certainly been successful in a large number of cases in which he has used it, relieving the tinnitus and vertigo and not increasing the deafness, although seldom improving the hearing to any extent. In the hands of others the operation has of late been used with similar gratifying results, and it undoubtedly has a large field of usefulness. A very valuable section of Dr. Burnett's work is devoted to chronic puru-

lent otitis media occurring in young children without external symptoms. The subject has of late assumed the greatest importance not only to the otologist, but to the general practitioner, and it is becoming more and more essential that all physicians should be familiar with the dangers arising from such a source.

The section on diseases of the nose and nasopharynx is written by Dr. Ingals in his usual interesting style. The arrangement of the chapters is somewhat peculiar, in that acute rhinitis and hay fever are embraced in the same chapter (III.), which is followed by a series of chapters on various subjects, before we come to Chapter VIII., in which the treatment of chronic rhinitis is taken up. Dr. Ingals is an advocate of the galvanocautery. In the removal of nasal tumors Dr. Ingals injects cocaine directly into the growth by means of a hypodermic syringe with a long silver nozzle; for the removal of adenoids he prefers forceps and general anæsthesia. The descriptions of the methods to be pursued in the various operations upon the nose are most excellent, and likewise the portions of the section devoted to the pathology of the various nasal diseases.

Dr. Newcomb's part of the work forms a fitting supplement to its predecessors. While concisely written and condensed, owing to limitations of space, it presents an excellent description of the various pathological conditions of the pharynx and larynx, with a summary of the most recent methods utilized in their treatment. The discussions of tuberculosis and syphilis of the larynx are very fair presentations of the present status of professional opinion on those subjects.

This book as a whole is one of the most useful contributions that has yet been made to the literature of laryngology, rhinology, and otology in this country. It possesses all the advantages of a book of composite authorship, while at the same time it is not a mere hodge-podge of conflicting views and statements. Although written expressly for students, no specialist in these subjects can afford to be without the book. The very brevity of the divisions renders their concise statements of facts particularly valuable. The book is handsomely got up, although, as seems inevitably the case in text-books of this nature, the illustrations are many of them old friends. F. R. P.

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DISEASES OF THE DIGESTIVE ORGANS IN INFANCY AND CHILDHOOD, WITH CHAPTERS ON THE DIET AND GENERAL MANAGEMENT OF CHILDREN AND MASSAGE IN PEDIATRICS. By LOUIS STARR, M.D., late Clinical Professor of Diseases of Children in the Hospital of the University of Pennsylvania; Consulting Pediatrist to the Maternity Hospital, Philadelphia, etc. Third edition, rewritten and enlarged. Illustrated. Philadelphia: P. Blakiston's Son & Co., 1901.

THE present volume has been changed in the following particulars: The forty-page chapter on the investigation of disease, appearing in the second edition, has been entirely cut out. Portions have been left out of the articles on the Eruption of the Temporary Teeth, from the Etiology of Enterocolitis, Cholera Infantum (including a clause relating to the differential diagnosis of this condition from sunstroke), a clause relating to the etiological relationship of dentition to gastric catarrh,

and a clause in the latter condition relating to dentition. Under the symptoms of tænia nana the paragraph relating to its similarity to mucous disease has been omitted, and two paragraphs under the treatment of intestinal parasites have been dropped. From the etiology and symptoms of tabes mesenterica and the chapter on Fatty Liver some of the old material has been dropped, and in the chapter on Suppurative Hepatitis the report of an illustrative case has been omitted. Numerous additions have been made to most of the articles in the book.

The following diseases are described for the first time in this edition: Rhachitis, scorbutus, lithæmia, Bednar's aphthæ, syphilitic stomatitis, membranous stomatitis, nasopharyngeal adenoid hypertrophy, proctitis, infectious follicular tonsillitis, brief descriptions of bothriocephalus, and the tænia cucumerina and tuberculosis of the intestines. The article on Dysentery has been entirely rewritten, and the article on Typhlitis and Perityphlitis, under the heading of Appendicitis, has been extensively reconstructed. The chapter on Feeding has been altered in minor details, and been added to by a description of the method of milk modification initiated by Dr. Rotch, and here described as "Laboratory or Percentage Milk Feeding." It would probably have been better to have omitted the term laboratory milk for two reasons: In the first place, the method is as readily and perhaps as extensively used out of laboratories as in them. In the second place, the use of this term in the restricted sense of a milk "composed of centrifugal cream of 16 per cent. fat strength (usually) separated milk from which practically all fat has been removed by the centrifugation of the cream, 20 per cent. sugar of milk solution, sterilized lime-water and distilled water," is something of an injustice to the milk laboratories. The object of these institutions is to modify milk according to the physician's formula. They do not restrict themselves to the production of a milk composed of the ingredients above referred to. For instance, whole milk and gravity cream are very extensively used in some of the laboratories, while milk, cream, and whey mixtures are commonly used in all of them. In short, any combination which the physician uses in his home modifications can and will be prepared by any of the laboratories in compliance with the physician's directions.

Dr. Starr's results in feeding from the laboratory, after having "thoroughly tested" the method, lead him to make the statement that he has "never seen an infant from two to ten months old able to satisfactorily digest a laboratory mixture of stronger proteid percentage than 1.50, and has often seen cases of two months and more unable to digest a percentage of 0.50." A statement of this character coming from a man in Dr. Starr's position and one of his vast experience in the feeding of infants cannot lightly be set aside. It is a matter of some importance, however, that the vast majority of pediatrists in this country, some of them of even wider experience in this particular line, have had such directly opposite results, and have learned to look upon percentage feeding as done both in and out of the laboratory as one of the greatest advances in modern medicine. These facts would seem to far outweigh this individual opinion and to greatly lessen its value. The theory which Dr. Starr advances to account for his results is "that in its composition (percentage milk) all of the fat is removed by a separator, and the fat as prepared for the infant is a recombination of this fat and an alkaline solution of the proteids and sugar.

In a word, the natural emulsion is destroyed." This he thinks in some way lessens the digestibility of the proteids. If this is the case it is difficult to understand why any recombination of these ingredients, no matter how low the proteid percentage required, should prove digestible, and yet Dr. Starr recommends percentage feeding for premature infants and infants up to the age of two months. One would scarcely expect the digestions of immature and young infants to be able to cope with problems that those of older infants are incapable of solving. It is something of a question in the mind of the reviewer if the natural emulsion of milk cannot be said to be destroyed in any milk as soon as the cream is separated, even by gravity. If such be the case, any recombination of milk and cream must produce an unnatural emulsion. Aside from this, practically all the cream produced by the best dairies is a centrifugal cream; therefore, according to the author's view, most of the milk modifications in common use are artificial indigestible combinations, a view which can scarcely be supported by common experience.

The advisability of describing the nutritional disorders in a work on the diseases of the digestive organs may be questioned, but the articles on simple atrophy, scorbutus, and rhachitis are so excellent that anyone purchasing this work will feel deeply indebted to the author for having included them. Of special merit are the latter two. Indeed, the reviewer knows no better text-book description of these diseases.

Modern research has pretty clearly demonstrated Murchison's view of the condition which he described as lithæmia to be incorrect. Some of the recent text-books have dropped the term; others have retained it, but abandoned his idea of its pathology. It is somewhat surprising, therefore, to find among the new material in this edition a chapter on Lithæmia in which Murchison's original views are retained. It is unquestionably true that as the result of defective metabolism there are stored up in the economy various products of retrograde metamorphosis which give rise to numerous and varied symptoms. The process of metabolism is so complicated that it is reasonable to suppose that the innumerable symptoms which are described under the term lithæmia are probably dependent upon a variety of toxic products due to defects in more than one of the organs involved in the process, and are, therefore, not any more capable of being described by any one term than would be the symptoms of the various fevers by the general term fever. Under the heading Lithæmia, however, Dr. Starr has given a most interesting and comprehensive description of those symptoms which we commonly see, but concerning the origin, nature, and treatment of which we know so little. S. M. H.

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PEDIATRICS: THE HYGIENIC AND MEDICAL TREATMENT OF CHILDREN. By THOMAS MORGAN ROTCH, M.D., Professor of the Diseases of Children, Harvard University. Third edition; rearranged and rewritten. Pp. xxi., 1021. Philadelphia and London: J. B. Lippincott Co., 1901.

THE latest edition of Dr. Rotch's *Pediatrics*, which, according to the title page, is technically the third edition, rearranged and rewritten, is a striking illustration of the importance of mere formal perfection in the

art of book-writing and book-making. The first edition of this really valuable treatise was a distinct disappointment to the many friends of Dr. Rotch, who had looked forward to the appearance of his *magnum opus* as an event of signal importance in the field of study in which its author had so brilliantly distinguished himself. Apart from its chapter on Infant Feeding, which alone would have marked an epoch in pediatric literature, there was much ground for criticism in the cumbersome lecture-room style, the lack of systematic classification and arrangement, and the undue prominence and discursive treatment of several divisions of the subject-matter, notably in those sections devoted to nervous diseases and the blood, which together occupied almost one-fourth of the whole book. A wealth of material, however, had been gathered together, and we have no doubt that Dr. Rotch realized the necessity for promptly revising the form in which it had been presented, even before his friendly critics had pointed it out.

The work of revision has been thoroughly carried out. The new edition contains just about one hundred pages less than the original volume, while nothing of importance has been sacrificed and considerable new matter has been added. This saving of space has been effected by eliminating unnecessary verbiage and quotation of cases, and by omitting certain of the least important illustrations.

The section on Feeding, which embodies the author's most notable contribution to pediatric literature, has been to some extent remodelled, and, if possible by slight changes, improved. We are pleased to see that Dr. Rotch has given much greater prominence than in his first edition to the subject of home modification on a percentage basis, and has added a section on the Theory of Percentage Modification, for which he has largely drawn upon the material of recent writers upon this subject.

In the line of additional material mention must be made of the excellent chapter on Typhoid Fever, which seems to have been altogether overlooked in the first edition; of a new section on Epidemic Cerebro-spinal Meningitis, which is thoroughly abreast of our present knowledge of this disease, and of a complete systematized article on Tuberculosis, which now for the first time receives treatment in a unified form. Cholera Infantum is properly classified under the general heading of Infectious Diseases, where, too, Influenza and Parotitis now find their proper place. A new section on Diseases of Nutrition gives a greatly improved, fuller, and better arranged section on Rhachitis than was found in the original text, while Osteomalacia, Scurvy, and Infantile Atrophy also appear under this heading in a new dress. The very unsatisfactory, because unsystematized, chapters on the Blood have been replaced by a well-arranged section on the Blood, the Lymph Nodes, and the Ductless Glands, which is entirely adequate Finally, it remains to commend the satisfactory manner in which the original material covering Nervous Diseases has been condensed into a systematic review of the subject, occupying less than half the space previously devoted to it.

The only cause for regret is that lithæmia in childhood has not received attention in this new edition. This affection of children of the better classes is daily becoming more and more important in practice, and it deserves adequate consideration in the complete text-book of to-day.

Altogether, this new edition of Rotch's *Pediatrics* is practically a new book, well balanced, well arranged, and beautifully printed, which preserves all the excellencies of the old book and eliminates all its defects.

T. S. W.

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A Handbook of Materia Medica, Pharmacy, and Therapeutics. By Samuel O. L. Potter, A.M., M.D., M.R.C.P. Lond., formerly Professor of the Principles and Practice of Medicine in the Cooper Medical College of San Francisco. Eighth edition, revised and enlarged. Philadelphia: P. Blakiston's Son & Co., 1901.

Dr. Potter's text-book has so long been esteemed an authoritative reference book on everything that pertains to the knowledge of drugs and their uses, that it seems difficult at first thought to realize that the seventh edition no longer was abreast of the times. A careful comparison of this with the latest revision, however, fully confirms the wisdom of the publishers in arranging for a new edition of this successful work.

Dr. Potter's unusual opportunities for study during his sojourn in the Philippines, among a strange people, and face to face with the little-known diseases of the tropics, has served to add much to his already able mastery of the subject of therapeutics, which earlier editions of his book have so fully attested. The text throughout has again been thoroughly revised, largely rewritten, and considerably increased by the addition of new material, which, however, has partly taken the place of material rejected as obsolete, so that the increased size of the book over the previous edition is only twenty pages.

A judicious conservatism has governed the admission of new drugs to a deserved place in the list of materia medica, only thirty-eight new articles having been added, from which those on urgentamin, argonin, creasotal, eucaine, heroin, holocaine, orthoform, protargol, and urotropin may be selected as specimens of the class.

Many other changes in arrangement of articles and in addition of new materials to the older text can only be referred to in passing. We can recommend this new edition as in every way superior to its predecessors, which is, perhaps, the most substantial praise that could be accorded it.

T. S. W.

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A Laboratory Course in Bacteriology, for the Use of Medical, Agricultural, and Industrial Students. By Frederic P. Gorham, A.M., Associate Professor of Biology, Brown University; Bacteriologist, Health Department, Providence, R. I. With 97 illustrations. Philadelphia and London: W. B. Saunders & Co, 1901.

Professor Gorham has undoubtedly produced one of the best students' laboratory guides to the study of bacteriology on the market. While avoiding unnecessary detail, he has so arranged his material as to give a comprehensive, methodical survey of the entire subject. The tabular method which the author has adopted in dealing with the general technique, characteristics, and classification of the different groups of

bacteria is not only commendable from a logical stand-point, but also enables the student, and especially the student of medicine, whose time must be divided among so many important studies, to gain with the least amount of effort a general understanding of what otherwise would be an extremely difficult subject to master. The illustrations are good and well chosen, not only of apparatus, culture, etc., but also of the bacteria themselves—the latter being for the most part reproductions from photomicrographs. The whole work shows throughout a painstaking, judicious selection and condensation of material, which is highly creditable to the author, and which will be very grateful to the student, who would otherwise be compelled to wade and flounder through some one of the numerous larger text-books on this intricate and bewildering subject, much to his own and his instructor's disgust and despair. The technique is thoroughly modern, amply sufficient for all practical purposes, and so arranged that the student will have no trouble in following directions even to the minutest detail. H. H. C.

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CLINICAL HÆMATOLOGY: A PRACTICAL GUIDE TO THE EXAMINATION OF THE BLOOD, WITH REFERENCE TO DIAGNOSIS. By JOHN C. DA COSTA, JR., M.D., Assistant Demonstrator of Clinical Medicine, Jefferson Medical College; Hæmatologist to the German Hospital, etc. Containing 8 full-page colored plates, 8 charts, and 48 other illustrations. 8 vo., pp. 450. Philadelphia: P. Blakiston's Son & Co., 1901.

THE preface to this book states that it is "designed as a practical guide to the examination of the blood by methods adapted to routine clinical work, and represents an endeavor to record the salient facts of hæmatology as they are understood at the present time. . . . A minimum amount of theoretical discussion has been introduced in the sections dealing with the physiology and pathology of the whole blood and the cellular elements." The first four sections of the book, covering about two hundred pages, detail the examination of the blood by clinical methods, the study of the blood as a whole, the detailed study of the hæmoglobin, erythrocytes, and the leucocytes. In the first section the description of the use of the various instruments of precision is excellent. The writer gives preference to the use of the Oliver apparatus over the von Fleischl, though he recognizes the clumsiness of the Oliver instrument as compared with the one in more common use. The reviewer has had some experience with the Oliver apparatus, but has abandoned it in preference to Dare's hæmoglobinometer, which he has found to answer very well the requirements of hospital use. The sections upon the erythrocytes and the leucocytes show a considerable research of the literature upon these subjects, and perhaps bring up to date the most commonly accepted views upon the now much discussed subject of the value of leucocytosis. Diseases of the blood, chlorosis, pernicious anæmia, the leukæmias, Hodgkin's disease, etc., occupy but seventy-five pages. The plates accompanying this section are well drawn, though none of the blood plates seem to have the accurate coloring of those in Cabot's work. Splenic anæmia is classed among the essential anæmias, and appears under this section. Some of the recent writers on splenic

anæmia and anæmia associated with splenomegaly have reached the conclusion that this disease should be classed among the secondary anæmias. There is a special chapter on the anæmias of infancy and childhood, which is good. In this section von Jaksch's disease, the anæmia infantum pseudoleukæmia, is described, and quite properly to the reviewer's mind, not "as a separate clinical entity, but rather as a form of secondary anæmia associated with marked leucocytosis and splenic enlargement." Section VII., the last section of the book, discusses general hæmatology, and includes the author's experience as hæmatologist to the German Hospital as well as in hospital and private work, and also the statistics of other hæmatologists.

As a whole, the book does not carry out the interpretation of its title. Blood examinations cannot well rest upon clinical experience, but should have for their rational basis a consideration of the pathological conditions which produce them, and these are, in large part, wanting in the book. As a manual for practical work it is trustworthy.

J. A. S.

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THE AMERICAN ILLUSTRATED MEDICAL DICTIONARY. For Practitioners and Students. A Complete Dictionary of the Terms used in Medicine, Surgery, Dentistry, Pharmacy, Chemistry, and the kindred branches, including much collateral information of an encyclopædic character, together with new and elaborate tables of Arteries, Muscles, Nerves, Veins, etc.; of Bacilli, Bacteria, Micrococci, Streptococci; Eponymic Tables of Diseases, Operations, Signs and Symptoms, Stains, Tests, Methods of Treatment, etc. BY W. A. NEWMAN DORLAND, A.M., M.D. Second edition, revised. 8vo. pp. 770 Philadelphia and London: W. B. Saunders & Co., 1901.

A SECOND edition of Dr. Dorland's work has been called for within a year, partly because of the popularity of the first, and partly in order that the author might fulfil his claim that the dictionary is up to date in every particular. Each twelve months at the present time adds a large quota of new medical words to the already overburdened list. Fortunately the inexhaustible stores of the Latin and Greek tongues are at the command of their makers, and the manufacture of new words can be continued indefinitely.

This dictionary is especially to be commended for its convenience as a work of reference. Although it contains 770 pages, the paper upon which it is printed is so light that the total weight of the book is very small. The definitions are concisely written and yet sufficiently explanatory. Special attention has been paid to the subject of pronunciation, and it would seem in many instances that the indications for pronunciation partook somewhat of the nature of a work of supererogation. Thus, in the case of ordinary English words of one syllable, such as flat, chalk, cord, and fit, it would hardly seem necessary to indicate the correct pronunciation, such indications merely serving to occupy space which might have been put to better use.

A number of excellent illustrations, rather above the average dictionary pictures, accompany the book, and tables, which serve in many

instances to simplify subjects and render them easy of grasp, are inserted. The book possesses especial value to the medical student or nurse who may desire a compendious dictionary in a handy form.

F. R. P.

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FIRST AID TO THE INJURED AND SICK; AN AMBULANCE HANDBOOK. By F. J. WARWICK, B.A., M.B. CANTAB., M.R.C.S., L.S.A., and A. J. TUNSTALL, M.D., F.R.C.S. EDIN. Philadelphia and London: W. B. Saunders & Co.

A WORK on "First Aid" is, of course, not intended in any sense as instruction for the physician, but for the laity in general, and in particular for nurses, railroad men, hospital corps of militia, etc., so that of necessity it must be elementary in character and technical terms avoided as much as possible. The authors of this little book have succeeded admirably in producing a work of this description. No one, of course, doubts the importance of first aid in saving life and limb and the desirability of educating the public to look after such emergency cases till proper professional help arrives. The opening chapters are devoted to anatomy and physiology, and do not go very deeply into the subject. The chapters on Bandaging, Treatment of Hemorrhage, Sprains, Fractures, Poison Cases, etc., are well and plainly written. The concluding articles on the transportation of sick and wounded will be of especial interest to the medical officers in the army and militia and to their hospital corps. While the methods differ very little from those in general use by military men, and which are set forth in the manual issued by the Government for the drill and instruction of the hospital corps, in this work they are much more clearly expressed. On the whole it is a very useful little book, and one to be highly commended.

G. M. C.

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A TREATISE ON PHARMACY, FOR STUDENTS AND PHARMACISTS. By CHARLES CASPARI, JR., Ph.D., Professor of the Theory and Practice of Pharmacy in the Maryland College of Pharmacy. Second edition, revised and enlarged. Pp. xiii., 766. Philadelphia and New York: Lea Brothers & Co., 1901.

THIS profusely illustrated book appeals to us not only by the evidence of scholarly thoroughness which it presents, but as well by the importance of the subject. That it has been written by a practical pharmacist there is ample evidence, and that the matter is intelligently presented the success which the book has attained bears testimony. In the first part, devoted to General Pharmacy, we find chapters on Pharmacopœias, Weights and Measures, Specific Gravity, Heat, Collection and Preservation of Crude Drugs, Mechanical Subdivision of Drugs, Solution, Percolation, Separation, Volatile and Non-Volatile Matter, Crystallization, and Classification of Natural Products Used in Pharmacy. Each one of these subjects is exhaustively presented and discussed.

The second part—Practical Pharmacy—takes up the various classes of medicines, washes, decoctions, extracts, etc., and gives their method of preparation, composition, with frequent notes of special precautions or a hint for advantageous work. Lastly, Pharmaceutical Chemistry takes up *seriatim* the various chemical classes, both organic and inorganic.

As we have read this book we have become more and more impressed with the importance of pharmacy and its claims to be recognized as a profession. We realize how much the advancement of the physician may depend on the concomitant progress of the pharmacist. While medicine continues to be practised drugs must play an important rôle in the treatment of disease, and subscription to this statement implies neither ignorance of nor the ignoring of the results obtained by so-called physio-therapy. The time is opportune for the undergraduate schools to insist that the student shall have a practical acquaintance with some of his armamentarium. A course in practical pharmacy supplementing the practical materia medica would lessen the mnemonic burden of the second year by giving him an object to which a name would adhere in mental image. Failing this, the recent graduate with this work in hand can readily acquire information which will be of practical value throughout his career. The author has done his work well; let us see his reward not only in better pharmacists, but as well in better informed and more useful physicians. R. W. W.

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Essentials of Physiology, Prepared Especially for Students of Medicine. By Sidney P. Budgett, M.D., Professor of Physiology in the Medical Department of Washington University, St. Louis. Arranged with questions following each chapter. Illustrated. Philadelphia and London: W. B. Saunders & Co., 1901.

This little work is intended to be used in conjunction with a text-book, not as a substitute for a more elaborate treatise on physiology. It admirably fulfils its purpose. A sufficient amount of space is given to the chemical aspects of physiology, and the author has succeeded in presenting the rudimentary essentials of this difficult and consequently much-neglected subject in a manner that should make it clear and comprehensive to the dullest student. Such modern subjects as the physiological action of the adrenals, the thyroid and the hypophysis, and the effects following removal of these glands, are conservatively treated. A number of tables diagrammatically explain the digestion of proteids, starch, and fats; they are well constructed and should prove helpful in memorizing the intermediate stages and the end-products of digestive dissimilation.

The full-page, half-tone illustrations of the fibre tracts of the spinal cord and their connections, of the cranial nerves, of the cerebral cortex, and of the structures concerned in the innervation of the cardiovascular system greatly enhance the value of this compend. The questions following each chapter are well selected and constitute a careful summary of the whole subject-matter treated. A. C. C.

VORLESUNGEN UEBER DIE PATHOLOGISCHE ANATOMIE DES RUCKENMARKS. Unter Mitwirkung von DR. SIEGFRIED SACKI, Nervenarzt in München, Herausgegeben von DR. HANS SCHMAUS, A.O., Professor u. I. Assistant am pathologische Institut in München. Wiesbaden: J. F. Bergmann.

IN many ways this is a remarkable book. It is the work of two authors seeking an ultimate knowledge, the correct understanding of the lesions underlying morbid states, and this end has been reached in an admirable manner by the joint efforts of an able clinician and an expert pathologist. We can cordially commend the idea to those laboratory workers who deal with dead-house material, and have no adequate conception of the clinical course of the disease which induces the lesions studied.

It is not too much to say that these lectures are the first in any language to set forth amply and thoroughly the correlation of anatomical structure and alteration with the various diseases of the spinal cord, and it is a pleasure to record that they not only constitute a marked contribution to our knowledge of the pathology of this portion of the nervous system, but they offer many excellent observations to the clinician as well.

With the recent marvellous studies on the anatomy of the nervous system, the intricacy of its structure is made appallingly definite; and whereas, heretofore, our knowledge of the diseases of these tissues has been almost entirely derived from the clinician, it is a sign of the times that anatomical research should step in and make clear many obscure points in spinal-cord pathology. Especially is this made apparent in this volume in the chapter on myelitis, a chapter which makes a veritable new outlook from the older stand-point.

The illustrative feature in the work calls for more than passing mention; it is a model of the highest type. The work is an invaluable one to the workers in this field. S. E. J.

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THE FOUR EPOCHS OF WOMAN'S LIFE. A STUDY IN HYGIENE. By ANNA M. GALBRAITH, M.D., Fellow of the New York Academy of Medicine; Attending Physician to the Neurological Department of the New York Orthopedic Hospital and Dispensary, etc. Philadelphia and London: W. B. Saunders & Co.

THIS compact volume of 193 pages, including the most excellent glossary, aims to throw light upon the various periods of the life of woman. There is but little that merits adverse criticism in the subject-matter of the book. Indeed, the only important point to be called in question is the interpretation of hemorrhage during the period of the menopause. In a popular book of this nature it would have been certainly wiser to have impressed the reader with the idea that all such manifestations were to be considered as of a most dangerous nature, as it is safest to consider all aberrant bleeding at this period of life as due to carcinoma until proved otherwise.

The question, however, presents itself, as it always does in considering a book of this class, as to whether its publication subserves a good end. In other words, whether the harm possible of accomplishment when

placed in the hands of the young woman does not outweigh the intended good. While we do not wish to be considered as casting any reflections upon the intention of the author, we are nevertheless compelled to say very positively that we should be very averse to placing the volume in its present form in the hands of any young girl. W. R. N.

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A TEXT-BOOK OF MEDICINE, FOR STUDENTS AND PRACTITIONERS. By DR. ADOLPH STRÜMPELL, Professor and Director of the Medical Clinique at the University of Erlangen. Third American Edition, translated by permission from the Thirteenth German Edition. By HERMAN F. VICKERY, A.B., M.D., Instructor in Clinical Medicine, Harvard University; Visiting Physician to the Massachusetts General Hospital; Member of the Association of American Physicians; Fellow of the Massachusetts Medical Society, etc., and PHILIP COOMBS KNAPP, A.M., M.D., ex-President of the American Neurological Association; Clinical Instructor in Diseases of the Nervous System, Harvard University; Physician for Diseases of the Nervous System, Boston City Hospital; Fellow of the Massachusetts Medical Society, etc. With Editorial Notes, by FREDERICK C. SHATTUCK, A.M., M.D., Jackson Professor of Clinical Medicine, Harvard University; Visiting Physician to the Massachusetts General Hospital; Member of the Association of American Physicians; Fellow of the Massachusetts Medical Society, etc. 1242 pages, with 185 illustrations in the text, and 1 plate. New York: D. Appleton & Co., 1901.

WHEN a book has reached its thirteenth edition in its original German dress, and has been translated into eight languages—English, French, Italian, Spanish, Russian, modern Greek, Turkish, and Japanese—the author is certainly justified "in the assumption that it has exercised some little influence upon the professional thought and practice of numerous medical readers." Of such a book it is pleasant to record the appearance of a third American edition. It is a book that not only reflects the best of contemporary German medicine, but it possesses the added charm of reflecting the personality of the author—for the book in many respects is a personal book. In an endeavor "to impart to the reader an insight into the origin and relation of the various morbid phenomena," the author has "brought the facts of clinical experience into the closest possible relation with the data of pathological anatomy and of general pathology, and" has "endeavored, also, in discussing therapeutics, to deduce from the nature of the symptoms a basis for rational medical opinion and treatment, although" he "has not undervalued the importance of simple experience." In the new edition a considerable portion of the book has been entirely rewritten—in particular, the whole doctrine of gastric diseases and several chapters in other sections, including gallstones, intestinal parasites, etc. We commend to the especial attention of the reader not only these chapters, but also chapters on the Diseases of the Myocardium, and the section of Diseases of the Nervous System, which for a long time has been recognized as a standard in this branch of internal medicine. The translators and the editor have performed their work well, and they have

added not only many notes throughout the book, but also special articles on the Plague, Yellow Fever, Dengue, etc., so as to adapt the work fully to the requirements of English-speaking practitioners. The book, as a whole, is to be most heartily commended. A. O. J. K.

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A MANUAL OF CHEMISTRY. A Guide to Lectures and Laboratory Work for Beginners in Chemistry, Epecially Adapted for Students of Medicine, Pharmacy, and Dentistry. By W. SIMON, Ph.D., M.D, Professor of Chemistry in the College of Physicians and Surgeons of Baltimore, in the Maryland College of Pharmacy, and in the Baltimore College of Dental Surgery. Seventh edition, thoroughly revised and much enlarged. In one octavo volume of 613 pages, with 66 engravings, 1 colored spectral plate, and 8 colored plates, representing 64 of the most important chemical reactions. Philadelphia and New York: Lea Brothers & Co., 1901.

THE seventh edition (1901) of this old and well-known text-book for medical students has just appeared, and continues as before a most excellent hand-book for the student of chemistry, whether from the medical stand-point or not. The book possesses several unique features. The most striking of these is the use of colored plates representing very accurately the appearance of 64 different tests and portraying faithfully the exact colors of each. No other text-book, as far as we know, has attempted this. It makes them very striking to the student, and will, without doubt, be of much aid in remembering certain important reactions.

The book is of 613 pages, and is divided into seven parts. Parts I. and II., "Chemical Physics and Principles of Chemistry," treat of the main laws that underlie the science and the basis on which it rests. Part III. takes up a study of the non-metals and Part IV. of the metals. The principal compounds of each are described, particularly those used in medicine. Both the chemical and the pharmaceutical nomenclatures are used. Part V. is devoted to a study of "Qualitative and Quantitative Analysis," including the detection and determination of the ordinary metals and acid radicals. The ordinary standard methods of analysis are given. In Part VI. we have a very excellent and concise summary of "Organic Chemistry." Many reactions are given, and a number of displayed or graphic formulæ of the benzene derivatives are introduced. Part VII., the last and perhaps the most important section of the book, is devoted to "Physiological Chemistry," including a study of the chemical changes in plants and animals, a study of the animal fluids and tissues (milk, urine, etc.), and a particularly good chapter on digestion, mainly from the chemical stand-point.

The book is to be welcomed to the shelves of advanced students as an old friend in up-to-date form, and will be of much value to the young student, who is always asking of the older men what book on chemistry can be recommended as a reference book.

It can be strongly recommended as a *precis* of much useful and valuable information, arranged in a manner both clear and lucid.

E. A. C.

SYPHILIS: ITS DIAGNOSIS AND TREATMENT. By WILLIAM F. GOTTHEIL, M.D., Professor of Dermatology and Syphilography, New York School of Clinical Medicine; Dermatologist to the Lebanon and Beth-Israel Hospitals, the West Side German Dispensary, etc. Profusely illustrated, 216 pages. Chicago: G. P. Englehard & Co., 1901.

THIS small work presents to the general practitioner in a most compact form all the information upon the subject that he needs. In his classification of the secondary cutaneous manifestations of the disease the author has been most wise in avoiding the confusing and complex sub-divisions generally found in larger works on syphilis. While it seems to be the proper thing to add to all books treating of syphilis numerous plates intended to show the various cutaneous lesions, as a matter of fact these cuts rarely furnish any real information regarding the appearance of the lesions. The present work is no exception to this rule; the plates indicating secondary lesions might represent almost anything, those, however, showing tertiary lesions are decidedly better, some of them showing the actual appearance very well. While nothing new concerning treatment is suggested, the chapter devoted to this subject expresses in a concise form the views of the best syphilographers of the day. We are sure that the author's little work will prove of great value to those desirous of obtaining the most information upon the subject with a minimum amount of reading. H. M. C.

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DOSE-BOOK AND MANUAL OF PRESCRIPTION-WRITING. By E. Q. THORNTON, M.D., Ph.G., Demonstrator of Therapeutics in Jefferson Medical College of Philadelphia. Second edition, revised and enlarged. Pp. 362. Philadelphia and London: W. B. Saunders & Co., 1901.

WE note with pleasure the appearance of the second edition of this very convenient manual, presented in a more attractive form and increased to the extent of nearly thirty pages. The additions are chiefly in Prescription-writing, Incompatibilities, and chapters devoted to Poisons and their Antidotes, and to Synonyms in the appendix. Various new remedies of approved value are noticed and commented upon, but which are not to be found in the first edition.

No one who reads current American literature can fail to be impressed by the uncouth abbreviations, mixture of old and new terminology, combinations of alleged Latin and its vernacular, which are to be found under the guise of prescriptions. To remedy this such a book is useful, and especially when we may congratulate the author upon his scrupulous adherence to official and classical nomenclature.

We have read it carefully, and beyond a few typographical errors, as Felix mas, p. 347, find but little to criticise. It has demonstrated its usefulness, and we trust its popularity will increase even more rapidly.

R. W. W.

# PROGRESS

OF

# MEDICAL SCIENCE.

## MEDICINE.

UNDER THE CHARGE OF

WILLIAM OSLER, M.D.,

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AND

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**The Blood in Tuberculosis.**—APPELBAUM (*Berliner klin. Wochenschrift*, 1901, vol. xxxix., p. 7) has studied the blood in cases of tuberculosis in Gerhardt's clinic with the following result: He divides the patients into those in the first, second and third stages of the disease. Patients in the first stage of tuberculosis may be considered in two groups. The first includes those in whom the disease has been of very gradual onset, patients who often have suffered from tuberculous affections (scrofula) since childhood. These are often tall, thin individuals, with characteristic phthisical chests, frequently with a family history of tuberculosis. In these cases the changes in the blood appear long before physical or bacteriological signs allow of a diagnosis. The second group are patients who appear in perfect physical health, well nourished, with well-shaped chests and without hereditary predisposition.

In the first of these classes there is well-marked anæmia, the red blood-corpuscles averaging about 3,800,000; hæmoglobin, 69 per cent.; leucocytes, 6500; specific gravity, 1049; solid residue, 19.5 per cent.

In the second class the blood examination is absolutely normal.

During the second stage of the disease, however, with the development of fever, night-sweats, and expectoration, the red blood corpuscles are often normal in number, 5,000,000 to 5,500,000; hæmoglobin, 90 to 95 per cent.; leucocytes, 8000 to 10,000; specific gravity, 1058 to 1060; solid residue, 22 to 24 per cent. This improvement the author justly considers to be only apparent, and due to the actual concentration of the blood.

In the third stage well-marked anæmia develops. The average number of red blood-corpuscles is from 2,000,000 to 2,500,000; hæmoglobin, 40 to 45 per cent.; specific gravity, 1040 to 1042; solid residue, 15 to 18.5 per cent. There is usually a leucocytosis of from 15,000 to 20,000.

The differential count of the leucocytes in the first stage, in those patients showing the picture of an anæmia, shows a relatively normal number of polymorphonuclear cells and a slight increase of eosinophiles at the expense of the small mononuclear elements. In the second stage the eosinophiles become less numerous, the transitional forms rather more numerous; the relative percentages of the lymphocytes and polymorphonuclear cells are but little changed.

In the third stage there is a well-marked relative increase in the percentage of polymorphonuclear cells. The eosinophiles are diminished and the transitional forms relatively increased in number.

[These observations serve to emphasize an interesting clinical fact upon which the reviewer has often insisted, namely, that during much of the course of pulmonary tuberculosis, though the face may be pale, a careful examination of the lips and mucous membranes will commonly reveal a color even equal to that of the normal individual, while examination of the blood shows a normal percentage of corpuscles and hæmoglobin.—W. S. T.]

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**Influence of Bile Retention on the Secretory Activity of the Stomach.**—Simnitzky (*Berliner klin. Wochenschrift*, 1901, vol. xxxviii., p. 1077) states that the observations in literature upon the condition of the gastric juice in jaundice from various causes differ greatly. Some observers have noted superacidity, others subacidity, others nothing remarkable. Simnitzky, in Botkin's clinic, examined 12 patients with jaundice, 7 catarrhal jaundice, 1 Weil's disease with hepatic colic, 3 hypertrophic cirrhosis, and 1 obstructive jaundice following pancreatic cancer. In all of these cases there was a superacidity depending entirely upon the free hydrochloric acid and the total quantity of chlorides. This superacidity disappeared in every instance with the disappearance of the jaundice. In one instance, where there was a relapse of the jaundice, the superacidity returned. "The increase in the secretory function of the stomach is then clearly dependent upon bile retention."

In a series of experiments on dogs in which the gall-ducts had been tied after œsophagotomy, the quantity of HCl was found to be nearly 50 per cent. above normal.

In a second series, in which an isolated ventriculus had been prepared according to the method of Heidenhain-Pavlov, biliary obstruction was followed by a marked increase of hydrochloric acid. Further experiment showed that this superacidity appeared to depend upon an increased irritability of the gastric mucous membrane, which reacted with undue vigor to the normal stimulus, but which became equally rapidly exhausted. Thus, in dogs repeatedly fed with small quantities, the secretion of the gastric glands is in the end diminished.

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**Influence of Alcohol upon the Natural Resistance Against Infection.**—Goldberg (*Centralblatt für Bakteriologie und Parasitenkunde*, 1 Abth., 1901, vol. xxx., pp. 696, 731) states that as a result of an interesting series of experiments made in the laboratory of Professor Chistovich (Tschistowitsch) the author arrives at the following conclusions:

1. Doves which are naturally immune against anthrax become subject to

infection after moderate doses (2 to 3 cm.) of 40 per cent. brandy, which produce only transient alcoholic intoxication but do not result in the death of the animal.

2. Chronic alcoholic intoxication diminishes the natural resistance of doves against anthrax.

3. Small doses of alcohol repeatedly given to doves infected with fatal doses of a culture of anthrax do not save the life of the bird, and only exceptionally prolong their lives in comparison with control doves; sometimes they cause apparently earlier death of the bird.

[These observations are in part confirmatory of those of Abbott made upon rabbits.—*Transactions of the Association of American Physicians*, 1895, vol. xi., p. 421.—W. S. T.]

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**The Origin and Prevention of Deposits of Oxalates in the Urine.**—Bearing in mind the fact that from 30 to 50 per cent. of all renal calculi consist mainly of oxalates, KLEMPERER and TRITSCHLER (*Berliner klin. Wochenschrift*, 1901, vol. xxxviii., p. 1289) have made some interesting observations. If, after an ordinary meal of spinach, about 100 mgr. of soluble oxalic acid is set free in the gastric juice, about 15 mgr. appear in the urine. The rest is, in greater part, destroyed by bacteria and ferments in the intestine. Small quantities of oxalate of sodium and oxalate of lime introduced hypodermically appear in toto in the urine, showing apparently that whatever amounts of oxalates enter into the fluids of the human body pass unchanged through the kidneys. But in human beings or animals fed upon a diet entirely free from oxalic acid, oxalates may yet appear in the urine. This they have shown to be due to the fact that oxalic acid may appear as a result of the digestion of kreatin, glycocol, or glycocholic acid. Thus, in a starving dog, oxalic acid appearing in the urine doubtless develops from the kreatin of the breaking-down muscle.

In order then to make the urine entirely free from oxalic acid, it will be necessary that the nourishment shall contain neither oxalic acid nor kreatin; in other words, no vegetables or meat, and yet sufficient nourishment to prevent loss of body albumin. This will scarcely be possible; but, as the authors point out, the question is not how to prevent the formation of oxalic acid, for oxalic acid, when in solution, is of no harm, but how to prevent the precipitation of oxalate of lime. As a result of a number of analyses the authors have concluded that the solubility of oxalate of lime is proportionate to the quantity of magnesia and in inverse proportion to the quantity of lime in the urine. The best diet for a patient with a tendency toward oxaluria should then be one in which milk, eggs, tea, cocoa, and many vegetables are forbidden, while meat, fat, bread, grains, rice, and the legumens, as well as apples and pears, are allowed. Klemperer does not recommend the absolute prohibition of vegetables, but only spinach and the various forms of cabbage, on account of the abundant quantity of lime which they contain. Moderate quantities of other vegetables should be allowed. The patient should be encouraged to drink much water; there is no especial contraindication for alcohol or coffee.

The quantity of magnesia in the urine may also be influenced by the administration of 2 grammes of sulphate of magnesium a day.

**Degeneration of the Islands of Langerhans of the Pancreas in Diabetes Mellitus.**—WRIGHT and JOSLIN (*The Journal of Medical Research*, vol. vi., No. 2, November, 1901, p. 360) refer to the work of Lagnesse, Schäfer, Diamare, Ssobolew, and Opie on the degeneration of the islands of Langerhans of the pancreas in diabetes mellitus and the probable disturbance of carbohydrate metabolism resulting from this lesion.

Among fourteen cases of chronic interstitial pancreatitis examined by Opie, the islands of Langerhans were shown to be the seat of hyaline degeneration in four. In three of these four cases diabetes had been present, but had been absent in the others. In the fourth case the islands were only slightly affected. What is more important, he found in two cases of diabetes mellitus in which there was no increase in the interstitial connective tissue of the gland, that these islands were extensively transformed into hyaline material. In one case the degeneration was strictly limited to the islands, while in the other it extended beyond their limits. As a result of his observations Opie concluded that in pancreatic diabetes the lesion is of such a character as to destroy the islands of Langerhans, and that where, although the organ is diseased, diabetes is absent, the interacinar islands are relatively unaffected.

Wright and Mallory examined sections from the pancreas in nine cases of diabetes mellitus and found the islands of Langerhans degenerated in two. In one of the cases the degeneration was very marked in these islands and practically confined to them. In the other case the islands were less markedly involved, and the gland also showed fat necroses. The remaining seven glands were practically normal. It is well to note, however, that most of the material examined was in the form of stock sections in the laboratory, which had not, of course, been specially stained with the object of demonstrating this lesion.

The writers think, nevertheless, that their results are strongly in favor of the hypothesis that lesions of these islands are important factors in the pathology of this disease.

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**Bacteriolysis and Typhoid Immunity.**—MARK W. RICHARDSON (*The Journal of Medical Research*, vol. vi., No. 1, p. 187), in the course of some interesting laboratory experiments, has made some observations which are most suggestive and seem to have an important bearing on the question of natural immunity and of immunity after typhoid fever. During the course of typhoid fever, if a quantity of fresh blood serum be added to an equal quantity of a bouillon culture of the typhoid bacillus, there is, in the vast majority of cases, not destruction but abundant multiplication of the typhoid organisms. If, however, the mixture of serum and bacilli be introduced into the peritoneal cavity of a normal guinea-pig we get the so-called "Pfeiffer's phenomenon," that is, there is not only a complete absence of multiplication of the bacilli, but there is absolute destruction and disappearance of the organisms. The essentials for the reaction are the specific typhoid or immune serum and also the tissues or fluids of a normal living animal. Richardson proceeded to ascertain whether results similar to the above could not be obtained with typhoid bacilli and sera studied by the hanging-drop process. In this he was successful. It was found that if a

loop of typhoid blood serum were added to a loop of a twenty-four-hour culture of the typhoid bacillus and observed in the hanging-drop under the microscope, there was inhibition of the growth of the bacilli, although they still multiplied slightly, but there was absolutely no evidence of destruction of the bacilli. If, however, a loop of normal serum were added to the mixture of typhoid serum and bacilli, it was observed that the typhoid bacilli were almost completely destroyed within an hour. In other words, the addition of the normal serum had the power of producing a bacteriolysis. Thus the observation of Bordet, that Pfeiffer's phenomenon could be observed under the microscope, was confirmed. It was at first found that this reaction was not constant, and it was afterward ascertained that the result was always constant if the three ingredients were added in a definite order. The two sera must not be mixed before being brought into contact with the bacilli. The bacilli must be mixed with one of the sera first before the other serum is added.

Observations were made to see what effect the serum of typhoid patients had at various stages of the disease. In the middle of the disease typhoid serum had no influence in causing bacteriolysis. The addition of normal blood serum caused rapid bacterial destruction. On the other hand, with the fall in temperature, the blood serum of the typhoid patient possessed definite bacteriolytic power. Thus, in the late stages, it acquired properties similar to those produced by the addition of normal serum. The practical importance of these experiments is that they throw some light on the unsatisfactory results obtained so far from serum therapy in typhoid. They indicate that by administering the curative serum there has been added something that the blood already contains in abundance. There is wanting, however, a factor which seems to be only supplied by normal blood serum. The writer seems to have demonstrated that in serum therapy in the future normal serum must also be administered in addition to the curative serum.

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**On the Occurrence of Strongyloides Intestinalis in the United States.**—THAYER (*The Journal of Experimental Medicine*, vol. vi., No. 1, Nov. 29, 1901) reports three cases of infection with strongyloides intestinalis observed in the Johns Hopkins Hospital during a period of three years. These are the first cases that have been reported in this country.

The report of the cases is preceded by a detailed account of the life-history of the parasite and the methods of development of the larvæ into the sex-ripe generation. The parasite is the recognized cause of the so-called Cochin-China diarrhœa, and was first discovered by Normad, a French naval surgeon, in the dejecta of individuals who had contracted severe diarrhœa in Cochin-China. Bavay, who carefully studied this parasite, gave it the name anguillula stercoralis. The following year Bavay found another small nematode worm in the small intestines of patients suffering from Cochin-China diarrhœa in association with the anguillula stercoralis. To the new parasite he suggested the name anguillula intestinalis. It was later decided that the two parasites were identical. In 1878 and 1879 Grassi and Parona discovered the parasite at a number of autopsies in Pavia, and in the latter year Grassi placed the worm in a special genus closely

allied to the strongylus, which he termed the strongyloides, and gave it the specific term strongyloides intestinalis. This classification is generally accepted. In the early eighties the strongyloides intestinalis was frequently found in association with the anchylostoma duodenale in the intestinal tract of workers in the St. Gothard tunnel. Until the report of Thayer's three cases the parasite had not been observed in the United States. The infection is recognized by the presence in the stools usually of the actively motile embryo, which in Bavay's case measured 0.33 millimetre in length, and 0.022 millimetre in width. The length of the full-grown female was about 1 millimetre; its breadth about 0.04 millimetre. The male was about one-fifth smaller than the female. A characteristic feature of the parasite is the occurrence of two bulbous enlargements of the œsophagus, the posterior of which is armed with three chitinous teeth.

The parasite apparently does not produce intestinal ulceration excepting in very rare instances. The injurious effects of the worm are supposed to be purely mechanical, although Calmette suspects that the parasite may give rise to substances acting as chemical irritants. The clinical manifestations of the disease are mainly those of a chronic diarrhœa and a comparatively mild anæmia. There are usually three or four pasty stools a day. Doses of thymol followed by a purge have given best results.

The first of Thayer's three cases had amœbic dysentery and intestinal infection with trichomonas intestinalis. The patient also had an hepatic abscess, and the case terminated fatally. The infection in this case may have occurred in Austria. The infections in the two other cases must have taken place either in Maryland or in Virginia.

The writer expressed the probability that infections with anchylostomiasis also occurred in this country. While the article was in press such an infection was found by J. L. Yates at an autopsy in the almshouse, Baltimore. A strong plea for thorough systematic examinations of the feces is made.

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**On the Toxicity of the Cerebro-spinal Fluid in Epileptics.**—Bellisari has shown that the cerebro-spinal fluid of individuals suffering from general paralysis is more toxic than in normal individuals, and that this toxicity is at its maximum after an epileptiform seizure. PELLAGRINI (*La Riforma Medica*, Rome, 1901, Ann. xvii., vol. ii. p. 638) has continued these researches with a view to determining the relative toxicity of the cerebro-spinal fluid in epileptics. In his researches the puncture was made between the third and fourth and fourth and fifth lumbar vertebræ. The quantity of fluid contained varied from 10 to 15 c.cm. Punctures were made in six cases of epilepsy. As a result of the inoculation of these fluids into guinea-pigs the author arrives at the following conclusions:

1. That the cerebro-spinal fluid of epileptics is possessed of a markedly toxic power.

2. That, injected into guinea-pigs, it results always in grave and intense convulsive phenomena, so much so that in some instances a status epilepticus is produced; it has, therefore, a convulsive power.

3. That cerebro-spinal fluid, extracted immediately after the convulsion, has a toxic and convulsive power considerably greater than that obtained at periods far removed from the paroxysm.

4. That the so-called anti-epileptic drugs exercise no influence upon the toxicity of the cerebro-spinal fluid.

5. That cultures upon broth and gelatin from the cerebro-spinal fluid of epileptics remain sterile. Lumbar puncture appears to have no influence upon the course of the disease.

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**Gangrene of the Extremities after Scarlet Fever and Other Infectious Diseases.**—EICHHORST (*Deutsche Arch. f. klin. Med.*, 1901, lxx., 519) reports a case of gangrene of the left leg occurring during a very severe case of scarlet fever in a child, aged four years. On the sixteenth day of the disease, during desquamation, the child complained of pain in both legs, with tenderness on pressure in the muscles. During the night and on the morning of the fourth day after this the lower half of the left leg and foot were found to be pale and cold. This gradually went on to gangrene, for which, after two weeks, amputation was performed, the child making a satisfactory recovery.

The popliteal artery was found to be clear above, but the lumen appeared narrow and the wall was somewhat thickened. About 1 cm. above the point of division of the popliteal the vessel was entirely closed by a thrombus which extended about 1 cm. down into the two branches. In microscopical sections it was shown that the thrombus started from a very small area of endarteritis. Just above and below this point the arterial walls were quite free from change. No bacteria were found in the vessel wall or in the thrombus.

Gangrene of the extremities in scarlet fever is a very unusual complication. Eichorst has found but two similar cases in the literature. In one of these instances, that of Pearson and Littlewood, the scarlatinal process was extremely mild. In all three cases the thrombosis occurred during the period of desquamation, though in one instance it was as early as the ninth day. The onset of the occlusion was sudden in all cases. In two the pain in the legs was complained of for a short time beforehand, while in one discoloration of the skin was the first striking change. Eichhorst points out, in an interesting manner, that the sudden occlusion of an artery is by no means an evidence of embolism. Not a single one of Eichhorst's cases of cerebral thrombosis has had other than a sudden onset, similar to that seen in embolism or hemorrhage. A sudden onset appears to be the rule, also, in thrombosis of the arteries in the extremities. The author reports a case of autochthonous thrombosis of the right axillary artery occurring in influenza with apoplectiform onset.

Eichhorst has collected and tabulated 166 observations of arterial thrombosis in the extremities during acute infectious diseases; 42 of these occurred in typhus, 40 in typhoid fever, 19 in influenza, 14 during the puerperium, and 10 in pneumonia. The commonest seat of the thrombosis was in the legs.

Under all circumstances, arterial thrombosis in the extremity is a very serious complication. Death occurred in 39 per cent. of these cases. In many of these cases proper pathological investigations are wanting, but in 65 the thrombus in the artery was demonstrated. Satisfactory reports as to the condition of the heart are, however, wanting. In the majority of cases,

however, the onset was not as acute as in the author's instance, and he is inclined to believe that in most instances the condition was secondary to an endarteritis rather than to embolism.

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**An Analysis of Nine Hundred and Forty-nine Cases of Pneumonia.**—SEARS and LARRABEE (*The Medical and Surgical Reports of the Boston City Hospital*, Twelfth Series, December 1, 1901) have made an elaborate analysis of 949 cases of lobar pneumonia which came under treatment in the second and third medical services of the Boston City Hospital, from the years 1895 to 1900, inclusive. Cases in children under fifteen years of age were excluded. The disparity in the number of cases in the two sexes, 714 males and 235 females, was in part attributed to the greater hospital accommodation for the former sex, but mainly to the more frequent abuse of alcohol by men. In 660 cases the disease began suddenly; in 466 with a chill. In 238 cases in which the presence or absence of abdominal symptoms was noted, nausea or vomiting occurred 45 times, diarrhœa 20 times, both nausea and diarrhœa 12 times, a total of 77 (nearly 33 per cent.) Pain below the costal margin was frequently present, and in several cases appendicitis was simulated, especially when the pain was associated with muscle spasm. The right lung was affected nearly twice as often as the left. Their statistics do not strongly support the statement, so generally made, that the disease is more fatal or even more severe when it attacks the upper lobe. The temperature fell by crisis (*i. e.*, reached normal within forty-eight hours from the commencement of the drop) in 424 cases. The earliest date upon which it occurred was the second day, and the latest the nineteenth. By far the largest proportion of crises occurred between the sixth and ninth days. Death occurred in 29 cases after crisis. The average day for complete defervescence in the cases with lysis was 12.37, in those with crisis it was 9.45, showing that crisis shortens the course of the fever relatively by nearly three days. Of the 949 cases, 341 (35.9 per cent.) died. Of these 91 were moribund on admission. If these be excluded there still remains a mortality of 29.1 per cent., which the writers say leaves much to be hoped for. The percentage of deaths among males and females was 36.5 and 34 respectively. The harmful effects of alcohol were clearly shown. For total abstainers the death-rate was only 25 per cent., whereas 45.5 per cent. of the cases occurring among hard-drinkers ended fatally. The death-rate bore a direct ratio with the amount of albumin in the urine. Albumin was found in 624 out of 799 cases in which it was tested for. The leucocyte count showed that the mortality was much greater when the leucocytes were below 10,000 than when they were above this figure. The peculiar tendency of pneumonia to recur was shown by the fact that 86 patients had had one or more previous attacks. The highest number was 7; three was not very unusual. Autopsies were obtained in only 72 cases. In 36 of these the pneumococcus was isolated either alone or with other organisms from the blood. No antemortem blood cultures were taken. Pleurisy with definite signs of effusion occurred in 53 cases. In 34, of whom 8 died, it was presumably serous. In 19 it was purulent, of whom 7 died. Pericarditis was diagnosed in 19 cases, death occurring in 11. Phlebitis occurred in 10 cases, the largest number involving the veins of the left lower extremity. Meningitis was

diagnosed in 7 cases, autopsies being obtained in 3 of these. In these three cases the meningitis was regarded as a manifestation of a general infection, as an acute endocarditis was present in all. Acute endocarditis was found in 9 cases at autopsy, most often at the aortic valve, which was affected in 7 instances, 5 times alone and once each with the tricuspid and mitral. The mitral was involved alone twice. Eight of the cases were due to the pneumococcus. Otitis media was present in 16 cases. Regarding treatment, those who received cold sponges or cold baths showed a slightly higher mortality (1.7 per cent.) than in those who did not receive them.

## SURGERY.

UNDER THE CHARGE OF

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**A Clinical Lecture on Idiopathic Dilatation of the Œsophagus.**—SWAIN (*British Medical Journal*, November 16, 1901) states that dilatation of the œsophagus which exists without any obvious mechanical obstruction is a rare condition. The author reports the case of a woman, aged twenty-six years, who complained of difficulty in swallowing and a sensation of choking followed by vomiting, especially at night. There was difficulty in swallowing and considerable pain in the chest, which, however, was relieved by vomiting. Examination showed that a tube could be easily passed into the stomach. After washing out the stomach through the tube and then withdrawing it about eight inches of undigested food could be washed out of the œsophagus. The reaction of the fluid removed from the stomach was acid, while that from the œsophagus was neutral. Treatment has not proved very satisfactory—electricity, tonics, and feeding with the stomach-tube have given no relief. A comparative degree of comfort only has been obtained by the ingestion of soft foods and the systematic lavage of the dilated œsophagus. The question of gastrostomy has been considered, but has not been thought advisable as long as the patient is keeping up her nutrition.

**The After-care of Cases which Have Been Operated upon for Perforation of the Stomach.**—GILFORD (*British Medical Journal*, November 16, 1901) states that the most important points in the after-treatment of these cases are the food, the position occupied by the patient, and the use of aperients. Food: This should of necessity be liquid, either previously digested or of such a character as to require no gastric digestion. If the

indications are favorable, nothing but water should be given during the first twenty-four hours. If the operation has been severe, or if there is reason to suppose that the stomach will not tolerate liquids, it is best to inject a pint of warm water into the rectum to begin with. This may be repeated every four hours, and the quantity should vary according to the tolerance shown by the patient and the degree of thirst. In the great majority of cases hot water may first be given by the mouth four hours after the operation, but only a teaspoonful at a time should be allowed, and care should be taken that it is really hot. All fluids should be stopped as soon as nausea is felt, and should not be given again until after the lapse of an hour or more. When it is found that no nausea or sickness is produced, a little food may be introduced with advantage. Milk is a bad food to begin with, for the reason that it contains proteids, and therefore undergoes digestion in the stomach. Peptonized milk is equally objectionable, for the reason that peptones are decidedly irritating, and the milk so treated is not palatable. While food should not be unpalatable, it must not, on the other hand, be too rapid or stimulating For this reason, beef-tea and the other watery extracts of meat are objectionable. There is a similar objection to the use of alcoholic drinks, such as whiskey and champagne, whose stimulating action entirely overshadows their nutrient value, whatever that may be, and they should be considered rather as drugs than as foods. The combinations of alcoholic drinks with eggs are most undesirable. The best food that fills all the requirements is grape sugar flavored with raisins. It is best made by pouring boiling water on to half its bulk of chopped raisins. This is stewed for two hours and then filtered. The filtrate may be given either with water or without, and either hot or cold, according to the wishes of the patients. The author states that a decoction of malt made in a similar manner has proven equally serviceable, but, as a rule, it is not as palatable as the "raisin tea." After raisin and malt have been given from one to three days, a mixture of cream and water should be added to the list. This consists at first of one part of cream to twelve of water, but it is gradually made stronger until it is double this strength. These three preparations may be continued until the end of the first week or longer, but generally after the cream has been given for a day or so, one should mix with it some starchy food containing not more than a trace of proteid, such as arrow-root or corn flour. At the end of a week, if the patient has done well, solid food may be commenced, and to begin on it it is best to select those foods that undergo intestinal rather than stomach digestion.

The position of the patient should be regulated by the physiological requirements and the position of the ulcer. In the case of ulcers on the posterior surface the patient should first be placed well over on to the right side, and should afterward assume the sitting-up position, or a compromise may be affected by raising the shoulders and turning the patient slightly over to the right. This position is good for all ulcers except those which are low down on the anterior wall, and it may then perhaps be best for the patient to be lying on his back.

An enema of four ounces of glycerin mixed with half an ounce of turpentine should be given twenty-four hours after the operation; the time should vary according to the amount of distention and eructation of gas. Soap and

water with turpentine may also be given, and either of these may be repeated every four hours until decided relief is obtained.

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**The End Results of Castration for Tuberculosis of the Testicles.**—BRUNS (*Archiv f. klin. Chir.*, Band lxiii., Heft 4) states that the importance of this subject cannot be over-estimated. As the result of a discussion before the Paris Society of Surgeons two years ago, it was determined that the majority were against castration. Briefly the arguments that have been urged against castration are: 1. It is often unnecessary to sacrifice the whole testicle, as almost invariably it is only the epididymis that is affected. A destruction of the tubercular area or the excision of the epididymis suffices in these cases. 2. Excision of the testicle is often insufficient, as other portions of the urogenital apparatus may be affected. The author's experience has been that tuberculosis of the testicle itself is usually secondary to tubercular infection elsewhere in the urogenital tract. 3. The excision of both testicles or a double vasectomy is not to be considered, because of the severe psychic disturbances which almost invariably follow, and also in tuberculosis of each testicle there is usually infection of the prostate, seminal vesicles, and other portions of the urinary tract. The author reports 111 cases in which operation was performed; in 78 cases a one-sided castration, and in 33 cases both testicles were removed. In all these cases the vas was resected high up, but the prostate and seminal vesicles were not touched. A careful study of the history of these cases showed that in the first six months after the appearance of the disease the head of the testicle had become involved. In the Berne clinic in 75 per cent. of the cases the involvement of the testicle was bilateral. It is a question whether or not early castration can prevent this large percentage of involvement on each side. In 38 per cent. of the author's cases the disease was bilateral. In those cases in which castration of one side was performed, 23 per cent. ultimately developed tuberculosis of the other testicle, which usually is apparent within two years after the castration. It is probable that in fully one-half of these cases both testicles were involved at the time of operation. Of the one-sided castration cases, 12 per cent. died of urogenital tuberculosis, 15 per cent. of tuberculosis of the lungs or other organs; but it is important to note that of these cases fully one-third at the time of operation had tuberculosis of either the lungs, bones, joints, or glands. After one-sided castration, 46 per cent. of the cases remained cured, the period of observation varying between three and thirty-four years. After bilateral castration 15 per cent. died of urogenital tuberculosis elsewhere, and 56 per cent. of the cases remained cured, the period of observation varying between three and thirty years. In not a single case was there any psychic disturbance as the result of this bilateral operation. The results of castration performed in the presence of tubercular involvement elsewhere, either in the urogenital tract or other portions of the body are not encouraging; in fact, as a general rule, operation is contraindicated in these cases. In conclusion, it may be stated that the results of castration for tuberculosis of the testicle are very much better than one dares to believe, and compare very favorably with the results obtained by the conservative method of treatment. In fact, there is no positive proof against the value of castration in these cases.

**Operation for Epityphlitis in the Free Interval; Entero-anastomosis.**—MARTIN (*Centralblatt für Chirurgie*, September 28, 1901) states that Jaffe recommended entero-anastomosis as the best operation in the free interval for those rare cases of epityphlitis in which it is impossible either to find the appendix or to remove it. Jaffe reports two such cases, in each of which he resected the cæcum, but both developed a fecal fistula, while in another case he performed entero-anastomosis after a long and fruitless search for the appendix, but the case died of peritonitis. As a result of this experience Jaffe has since stated that he believes entero-anastomosis to be an operation of no value in this type of cases. The author reports the case of a man who had had repeated attacks of epityphlitis during three years, the attacks recurring at shorter intervals, with finally the formation of a tumor in the ileocæcal region, severe pain, and other symptoms of intestinal obstruction. As a result the patient was incapacitated from his work, and operative interference was decided upon. On operation it was found that the ileum was bound down to the cæcum with old tight adhesions, and as a result it was impossible to find the appendix. So then the ileum was then anastomosed with the colon and the wound closed. The patient made an uninterrupted recovery except for attacks of slight pain in the ileocæcal region. Although it is impossible to draw results from one case, still this case shows that in those cases of relapsing epityphlitis, operated on in the free interval, where the appendix cannot be found except by a prolonged search, or even then not at all, it is much better to perform entero-anastomosis at once than to endanger the patient's life by a perhaps fruitless search for the appendix.

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**The Surgical Treatment of Thrombosis of Varicose Veins of the Leg.**—KRAMER (*Centralblatt für Chirurgie*, No. 14, 1901) states that thrombosis is a very unpleasant complication of varicose veins which is generally followed by repeated attacks of inflammation, swelling, eczema or even abscesses, which can only be cured after weeks or months of careful treatment and rest in bed. The author recommends an incision, under local anæsthesia, over the thrombus, the opening of the vein in its longitudinal direction, and then carefully turning out the mass of clot. The author has performed this operation in fifty cases with most gratifying success; in no case were there sequelæ such as emboli, fistula nor bleeding from the open vein, which was impossible, because the peripheral and central lumen were closed or obliterated by clots. The wounds healed kindly by the patient being at rest, and left behind small painless scars. The veins became obliterated, and under careful asepsis this operation is a simple and safe method of treatment.

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**Experimental Uro-genital Tuberculosis.**—BAUMGARTEN (*Archiv für klin. Chirurgie*, 1901, Band lxiii.) as the result of his experiments states that he was unable to produce tuberculosis of the testicle by injecting tuberculous material through the urethra. By this means it was possible to produce tuberculosis of the deep urethra, prostate, and bladder, but never of the vas deferens, testicles, ureters, and kidneys. On the other hand, in every case in which the testicle was inoculated the disease extended to the vas deferens and prostate, but in no case did the other testicle or vas deferens become involved. The author states that he finds the explanation for his successes

and failures in the generally known law that tubercle bacilli will never travel against the current of fluids, whether they be secretory or excretory; tuberculous infection may descend from the kidney or ascend from the testicle, but never vice versa. Clinically it has been noted that the disease may have the testicle as its primary focus.

**Suture in Fracture of the Patella.**—BARKER (*Archiv für klin. Chirurgie*, Band lxiii., Heft 4), after describing in detail the technique of his well-known method of subcutaneous suture, states that he has performed this operation twenty-one times. With the exception of one case, which died of delirium tremens on the seventh day after the operation, the results were perfect, the patients regaining the full use of their legs.

**Discussion upon Spinal Anæsthesia.**—HENDRIX (*Jour. de Chir. et Annales de la Soc. Belge de Chir.*, No. 7, 1901) states that Bier, the discoverer of this method of anæsthesia, has stated that he considers it more dangerous than chloroform, disapproves of the enthusiasm with which it has been received, and that it should never be employed without full knowledge of those modifications which have been found to be indispensable.

## PEDIATRICS.

UNDER THE CHARGE OF

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**Influenzal Nephritis.**—D. J. MILTON MILLER (*Archives of Pediatrics*, January, 1902, p. 1) reports a marked case of acute hemorrhagic nephritis complicating influenza in an infant of thirteen months, and makes an elaborate analysis of forty cases of influenzal nephritis. From this study he draws the following conclusions:

Nephritis is a rare complication of influenza, occurring chiefly in young adults and children, and in infancy is almost unknown. Albuminuria is more common and is probably present in all severe cases. Hæmaturia alone is not infrequent, and, like nephritis, is seen oftenest in early life. The sexes are affected equally. The nephritis may appear early in the disease, or at varying periods after the acute symptoms have subsided. It is usually an early complication, occurring in one-half the cases within eight, and in two-thirds of the cases within twenty-one days of the commencement of the influenza. The clinical type varies: it may be that of an ordinary acute nephritis, but in the majority of cases it is of the hemorrhagic type, this form being especially frequent in young adults and children. Œdema is

absent in more than half of the cases, and is apt to be slight. The onset is usually attended with fever. The nephritis is of short duration, generally lasting under three weeks. The prognosis is good, recovery being the rule; although a small number of cases pass into the chronic subacute stage. When influenza attacks those whose kidneys are already diseased, it is apt to be serious and fatal. From the meagre pathological reports the lesions appear to be those of an infectious or toxic nephritis, often taking the form of a glomerulo-nephritis.

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**A Case of Acute Articular Rheumatism in an Infant Twenty-seven Days Old.**—PAUL J. BARCUS (*Archives of Pediatrics*, January, 1902, p. 37) reports a case of articular rheumatism in a new-born infant, the second child of healthy parents. At birth the baby weighed seven pounds, was perfectly healthy and continued so, although artificially fed, until the twenty-seventh day of life, when the mother noticed that its left arm seemed paralyzed and was painful when moved. The physician was not called until the third day of the disease, when he found the groin temperature 99.5°, and the pulse 120. The left elbow was much swollen, red and very sensitive. The child was taking nourishment well and there was no gastro-intestinal disturbance. On the following day the left wrist also was affected, and one day later the knee and ankle of the same side were involved, with increase in the temperature to 102°, and in the pulse-rate to 130. Subsequently the right knee and ankle became affected, followed in a few days by involvement of the right elbow, and, later, of the right wrist. The temperature never exceeded 102°, but after subsidence to normal on the nineteenth day the pulse remained somewhat high (150) for several weeks. Profuse acid perspiration was present early in the attack. About a month later the right knee again was swollen, red, and sensitive, but returned to normal in a week. The treatment consisted of salicylate and bicarbonate of sodium, a grain of each every three hours at first, and then less frequently. These doses were continued for some time after the first attack and were resumed during the relapse. No digestive disturbance occurred. Two months after the beginning of illness the infant was gaining slowly and was entirely free from the joint affection. The heart showed nothing abnormal on auscultation, but was beating at the rate of 125, with the apex slightly displaced.

The only suggestion of hereditary taint was an attack of what the doctor had called muscular rheumatism of the post-cervical muscles, which the mother experienced when five months pregnant. It lasted for one week, and was not accompanied by fever or joint involvement. No history of chorea or tonsillitis in either parent was elicited, and no pus focus or tendency to joint suppuration could be discovered in the infant.

The striking features of the case pointed out by the author were the great tolerance of the stomach for the medicine and the remarkable regularity of all symptoms that go to make up the classic picture of acute articular rheumatism.

[This case is peculiarly interesting, besides, as suggesting confirmatory support to the theory of the infectious origin of rheumatic fever, in favor of which might be adduced the polyarticular character of the attack and the

well-known susceptibility of the newborn to infectious processes, for which the umbilical wound offers a favorable port of entry. The absence of gastro-intestinal symptoms seems to exclude the possibility of a lactic-acid intoxication through the food. The possibility of maternal influences of a similar character are also eliminated, since the child was nourished artificially, presumably for some time before becoming ill.—ED.]

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**Diagnosis of Suppurative Pericarditis in Children.**—FREDERICK E. BATTEN (*Pediatrics*, November 1, 1901, p. 328) calls attention to the difficulties of diagnosis of this condition, which he has found to be present in nearly 3 per cent. of the deaths in the records of the Children's Hospital, Great Ormond Street, London. This paper is based on the observation of some six cases, five of which were boys and one a girl; their ages varied from ten months to three years. Their illness on admission to the hospital had lasted from four to nine weeks, and the total duration of the illness from the onset till death varied from seven to fifteen weeks. In every case a definite onset to the illness could be fixed, although it was not necessarily acute. In two cases measles had been the starting-point of the disease, while in the remaining cases it had been bronchitis or pneumonia. The importance of careful attention to the history is great, and the history obtained closely resembles that obtained in cases of empyema rather than the longer history of malaise which is usually obtained in cases of tuberculosis.

It is difficult to point out any very definite feature in the temperature which may be considered characteristic of the disease, but sudden falls are not uncommon and are attended with collapse; the general curve of the temperature is irregular, with but few subnormal points. The pulse is almost uniformly rapid and out of proportion to any distress or discomfort which the child may exhibit; in fact, a pulse of 150 or 160 may be found with apparently little distress. The respiration is usually increased, but maintains its normal ratio to the pulse.

The children are usually pale, often with fat and flabby cheeks; their bodies are often fairly nourished, but the muscles are flabby and wasted. There may be some œdema of the legs and feet, but œdema of the chest wall has never been observed by the author.

Severe attacks of syncope not infrequently occur. The impulse of the heart is generally to be felt either in the normal situation or in the epigastrium. The area of cardiac dulness is not necessarily increased. No murmur or alteration of the sounds of the heart could be detected, though they were noted as feeble in one case; but at no time was any pericardial friction audible. With regard to the lungs, it is important to note that in every case there was evidence either of apical or basal consolidation of the lung, or of effusion into the pleura, and numerous catarrhal sounds were to be heard, which, owing to the chronicity of the disease, were likely to be attributed to tuberculous infection.

In the post-mortem examinations of these cases both pleuræ were universally adherent. In nearly every case there was more adhesion between the sternum and the outer surface of the pericardium than normal; and while in three cases the area of the pericardium was noticeably increased,

and in two others in which the area occupied by the pericardium and the abscess together was considerably in excess of the normal pericardial area, it had not been detected on physical examination during life.

The amount of pus varied from a few drachms to six ounces; in some cases it was a thin opalescent fluid, and in others a thick pus embedded between masses of lymph. It is noteworthy that in four of these cases there was a localized purulent effusion into the pleura, while out of nine cases of fatal empyema in the hospital at the same time the pericardium appeared normal in all.

The use of the exploring-needle is deprecated, incision in an intercostal space or resection of a rib being considered a safer procedure, even for diagnostic purposes. While no pathognomonic sign can be suggested, the points emphasized in the paper should serve to arouse an intelligent suspicion of the condition, and operative treatment by incision and drainage offers the only possibility of recovery, though the percentage must, unfortunately, be small.

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**Serous Meningitis Due to the Typhoid Bacillus.**—GUINON (*Société de Pœdiatrie*, Séance, October 8, 1901; *Revue Mensuelle des Maladies de l'Enfance*, November, 1901, p. 529) saw in consultation a child suffering from typhoid fever, which had begun with disturbance of the stomach and torticollis. The course of the disease had been characterized by high fever, ranging for a time between 104° and 105.4° F. Early in the course of the disease the attending physician had observed a rigidity of the neck, but owing to the absence of Kernig's sign had dismissed the thought of meningitis. Several days later, when Guinon saw the patient, the symptoms of meningitis were quite distinct. Lumbar puncture gave issue to a serous fluid which was found to contain typhoid bacilli. The case terminated fatally.

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**A New Sign of Infantile Pneumonia.**—WEILL, of Lyons (*Revue Mensuelle des Maladies de l'Enfance*, October, 1901, p. 482), calls attention to a new sign which he has observed in pneumonia, and one that is nearly always constant. This is a lack of expansion of the subclavicular region of the affected side. This sign, which has been watched for in all affections of the respiratory tract, has been encountered only in pneumonia. In pleurisy and pneumothorax lack of expansion may be noted on the affected side, but it embraces the whole side and is in direct connection with the seat of the evolution. It may be confined to the base, or, if the effusion is extensive, may involve the whole side. In pneumonia, on the contrary, the lack of expansion is confined to the subclavicular region, even and especially when the pneumonia affects the base. It is an early sign which is observable from the first day and lasts often through the whole course of the disease.

This precocity constitutes the chief value of the sign, for it often happens that the physical signs are wanting up to the fifth, sixth, or seventh day in certain forms of the disease. It is well known that at the beginning pneumonia may simulate various affections, one of the most important of which is appendicitis. An instance is given in which Prof. Weill was enabled by this sign to make a correct diagnosis of pneumonia in a case which had been

diagnosticated as appendicitis. By the same means, pneumonia occurring in meningitis, typhoid fever, or influenza has been detected at once.

In practice this sign is easily elicited. It suffices to expose the chest while the patient is in the dorsal position waiting until the agitation, which accompanies the first mo nents of examination, passes away and the breathing becomes regular. The difference of expansion on the two sides may then be readily observed. This may be better appreciated by passing the hand alternately over the two apices, or a stylet may be used to emphasize the difference in expansion on the two sides.

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**Duodenal Ulcer in an Infant of Ten Months.**—VANDERPOEL ADRIANCE (*New York Academy of Medicine*, Séance, January 10, 1901; *Pediatrics*, July 15, 1901, p. 63) reported the case because of the very early age of the patient, a male infant in the Nursery and Child's Hospital. The family history was negative except that the mother was a hard drinker and irresponsible. On admission to the hospital the history was that the child had been very restless and had developed some gastro-intestinal symptoms. The condition became steadily worse, and the child cried constantly and placed his hands on the abdomen. After the first two weeks of rapid emaciation, and another fortnight in which the condition remained stationary, a relapse occurred, and about two pounds were lost in the week preceding death. Shortly before the end there were a number of bloody stools and some blood was vomited. At autopsy an ulcer was found in the duodenum, measuring 1 by 2 cm., which had nearly eaten through all the coats. The liver was excessively fatty.

The youngest case heretofore recorded was in a child, aged four years, the ulcer developing after a burn.

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**A Case of Subcutaneous General Emphysema.**—W. L. CARR and SAMUEL PIERSON (New York Academy of Medicine, section on Pediatrics, Meeting May 9, 1901; in *Pediatrics*, October 15, 1901, p. 314) report a rare instance of this complication in a boy, aged four and a half years, suffering from pneumonia. For five days there were noted only the clinical symptoms of pneumonia, without detectable physical signs; from this until the tenth day the physical signs became clearly marked in the right lung, and then the other lung became affected. Five days later slight emphysema of the neck was noticed, and by the next day it had become general on the arms and trunk. Both lungs cleared up about this time, but the emphysema extended all over the body, gradually disappearing within the next three weeks. The child made a good recovery. The case is interesting from the fact that this complication is extremely rare with pneumonia; and with the lobar type, of which this was an instance, a general emphysema is almost without exception the forerunner of a fatal result.

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**Gangrene after Scarlatina and other Infectious Diseases.**—EICHHORST (*Deutsches Archiv für klinische Medecin*, Bd. lxx., Hefte 5 u. 6) adds a new case of this very rare complication of scarlatina. The patient was a girl, aged four years, who had an unusually severe attack of scarlet fever. At the end of the third week symptoms of embolism of the left leg appeared

suddenly, followed by dry gangrene, the line of demarcation finally forming about the middle of the leg. Examination of the bloodvessels after amputation showed evidence of endarteritis of the popliteal artery with a thrombus 1 cm. above its bifurcation, extending into both the anterior and posterior tibial arteries. Pure cultures of the streptococcus pyogenes were obtained from the pus of an otitis media and from a furuncle on the face.

According to the author's researches in the literature only two other cases of gangrene following scarlatina have been recorded. Both these occurred in children and involved both legs. In the course of this study 166 cases of gangrene following infectious diseases were collected, of which the greatest number followed typhus, 42; typhoid, 40; and influenza, 19. Of the rarer instances 10 were found following pneumonia, 5 after measles, 1 after varicella, and 1 after diphtheria.

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**Treatment of Adenoid Vegetations.**—LAPEYRE (*Société de Pædiatrie*, Séance, October 8, 1901; *Revue Mensuelle des Maladies de l'Enfance*, November, 1901, p. 530) calls attention to the good effects he has secured in the treatment of adenoid vegetations by the internal administration of compound tincture of iodine. He commences with six drops three times a day, and gradually increases the dose, according to the age, until thirty to fifty drops are given. Despite these high doses he has never observed accidents. Atrophy and disappearance of the vegetations have been observed in a large number of cases.

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**The Use of Artificial Serum as a Means of Prognosis in Diphtheria.**—In a series of observations covering the use of subcutaneous injections of artificial serum in infectious diseases, especially diphtheria, RABOT and BONNAMOUR (*Lyon Médical*, 1901, No. 34) have brought out the fact that the reaction of the patient to such injections may be taken as an almost infallible indication of the favorable or unfavorable outcome of the case. If, after the injection a prompt diuresis occurs, without vomiting or diarrhœa, the outcome of the disease will be benign, whatever the general state of the patient; if, on the contrary, after injection the quantity of urine is not increased, and vomiting or diarrhœa occur, the prognosis is fatal, even though the child may seem to be doing well at the time. In all the cases tested in this way by the authors the disease terminated in accordance with this law. Sometimes a first injection has indicated a bad prognosis, even when the child's general condition seemed excellent; but a second injection has given the same response, which did not fail soon to be confirmed. In illustration of the certainty of prognosis under these conditions, the authors detail a case of diphtheria in a child, who, even after the injection, passed scarcely 300 grammes of urine in twenty-four hours, and had frequent vomiting attacks. He was apparently in good condition, however, laughing and playing about the bed. Despite the employment of several diuretics, including theobromine and lactose, and the use of saline intestinal injections, the excretion of urine did not increase, and death occurred on the eleventh day.

Despite the certainty of prognosis thus early indicated, treatment should not be neglected. The serum test indicates the condition of the kidneys,

and every effort should be made to favor the elimination of toxins. Diuretics should be employed, lactose in particular and lavements of salt solution. The general state and fever, if present, should receive attention. Further injections of artificial serum should be avoided, since they can only aggravate the conditions by producing an excessive increase of blood tension.

By observation of the reaction produced by subcutaneous injections of artificial serum, one may gain definite knowledge of the state of the heart and of the degree of infection, and thus may be established an almost certain prognosis in embarrassing cases, so frequent in the diseases of children, in which the general state does not correspond with the local, and *vice versa*.

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**A Simple Procedure for Increasing the Amount of Fat in Diluted and Sterilized Cow's Milk.**—ROMANOFF (*Vratch*, September 1, 1901) suggests a method for accomplishing such a modification which does not seem to possess any advantage over our more accurate laboratory methods. Fresh milk is diluted with an equal part of oatmeal-water containing 4 per cent. of sugar. The mixture is poured into six bottles, sterilized in Soxhlet's apparatus for ten minutes, and then placed on ice for from two to three hours. The bottles are then carefully removed, without shaking, and the lower half of the milk in each bottle is siphoned off. The remaining milk is shaken, warmed, and given to the infant. This upper milk is said to show three or four times as much fat as the part removed by siphoning, being estimated at from 2.9 to 3.6 per cent.

[As this method makes no provision for varying modifications of the proteid percentage, which in this mixture must be constantly about 1.50 to 1.75 per cent., a percentage which many infants cannot digest in the earlier months of life, it would seem that the product offers little advantage over other mixtures of the same kind, excepting, perhaps, in previous sterilization (which may be undesirable), and in the fact that the emulsion of the fats is little disturbed (also a gain of little practical importance in most cases). The inflexibility of the sugar percentage is also another defect.—T. S. W.]

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## THERAPEUTICS.

UNDER THE CHARGE OF

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**The Analgesic Antipyretics.**—DR. G. POUCHET gives a valuable practical summary of the analgesic antipyretics, based on the relation of their physiological action to their chemical structure. He divides them into six groups, as follows: (1) *Quinoline group*, to which belong analgine, kairine,

thalline, cupreine, quinine, euquinine, and chinaphtol; (2) *Pyrol group*, in which are found antipyrine and its salts, analgesine, acetopyrine, tolypyrine, tolysal, pyramidon, anilipyrine, quinopyrine, ferropyrine; (3) *Hydrazine group*, phenylhydrazine, pyroidine, antithermine; (4) *Aniline group*, aniline, diphenylamine, and other secondary amines, acetanilid, exalgine, euphorine, thermodine and neurodine; derivatives of para-amidophenol, phenacetine, triphene, lactophenine, citrophen, malakine, kyrofine, phenosal, cosaprine, phesine, phenocol, eupyrine and pyrantine; (5) *Aromatic acids*, benzoic, salicylic, benzacetine, aspirine, asaprol; and (6) *Alcohols* and *Phenols*. Of the first group the author believes that quinine is the only one that merits serious attention, the others having fallen by the wayside. In the second group antipyrine is the most important. The hydrazine group merits close attention, particularly because of the number of compounds which act prejudicially on the organism. Particularly all of the derivations of phenylhydrazine act upon the hæmoglobin of the blood, either to fix it and diminish oxidation or to cause hæmolysis. Antipyresis by such agents is not to be commended. The fourth group, the anilines, is perhaps the most important, containing the largest number of compounds. Many of this group have antiseptic actions as well; in fact, in some the antiseptic action overshadows any other for which it may be employed—thus the action of methylene blue on the malarial plasmodium is an example. Others of the group, acetanilid, phenacetine, are more employed for their analgesic action than for antipyresis. The aromatic acids, benzoic and salicylic, are closely allied, but benzoic acid being less readily broken up, oxidized, or eliminated is less of an antipyretic or analgesic, although an excellent urinary antiseptic. The salicylates, however, have marked analgesic powers, aspirine (salacetic acid), fulfilling most of the indications of this drug very acceptably. In the sixth group antiseptic action is the keynote, rather than analgesia or antipyresis. The author then discusses in detail the principles of the fascinating subject of the introduction of certain radicals into compounds and the resultant pharmacodynamic actions, a subject so ably discussed by recent advanced pharmacologists.—*Bulletin Général de Therapeutique*, 1901, vol. cxlii., p. 917.

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**Veratrum Viride in Pneumonia.**—Dr. T. G. Stephens believes in this drug for the treatment of pneumonia. In a series of fifty-four cases of pneumonia he reports fifty recoveries and four fatalities. The fatal results were necessarily so from the start. Norwood's tincture has given him the best results, and he employs the following formulæ: Tincture of veratrum viride (Norwood), 1; wine of ipecac or spirit of nitrous ether, 2. Ten drops every three hours, in a little water; increased one or two drops each dose. Tincture of veratrum viride (Norwood), 1; compound syrup of squill, 2. Same dose as above. Tincture of veratrum viride (Norwood), 2; tincture of aconite root, 1; syrup of tolu, 4. Fifteen drops every three hours, increasing three drops each dose.—*Therapeutic Gazette*, 1901, vol. xxv., p. 731.

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**Pulmonary Hemorrhages and Gelatin Injections.**—Drs. A. Hammelbacher and O. Pischinger, in two case of hæmoptysis, report successful treatment by means of subcutaneous injections of 2½ per cent. gelatin solution.—*Münchener med. Wochenschrift*, 1901, vol. xlviii., p. 2000.

[In this connection it may be well to bear in mind that in the same journal Dr. F. Kühn calls attention to the dangers which may arise from the use of these gelatin solutions if they are not absolutely sterile. He there reported a fatal case of tetanus following the use of gelatin which had been used to relieve a severe hemorrhage following adenoid operations.—R. W. W.]

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**Some New Preparations of Valerian.**—Drs. H. Kionka and A. Liebrecht say that the uncertainty of the action of valerian is wholly due to the instability of the preparations. Inasmuch as the fresh leaves are not always obtainable, with which to make comparatively stable preparations, they prepared a synthetic combination with ethylamid, producing a diethylenamid valerianate ($CH_3$, $CH_2$, $CH_2$, $CH_2$, N, $C_2H_5$). In lower animals, frogs, etc., convulsions and paralysis result from its use; in cats and dogs, much mental excitement, not due to the odor, may be added; in man but few effects were noted. In hysteria, neuralgias, hæmicrania, neurosis of traumatic origin, and in the nervous symptoms of the menopause and pregnancy the drug acted well. Its field of usefulness might be extended to the milder types of melancholia.—*Deutsche med. Wochenschrift*, 1901, vol. xxvii., p. 849.

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**Treatment of Rheumatism.**—Dr. D. K. Coverley presents in *résumé* some of the phases of evolution in the manufacture and use of anti-rheumatic remedies. The objections to salicylic acid being many, the search for substitutes has been both active and prolific. Salol, salophen, salocoll, and aspirine have each been used and found effective in particular cases. The author makes a special plea for acetyl-salicylic acid, aspirine, which he has found agreeable and non-irritating. In alkaline media it liberates salicylic acid in a nascent state, and is an efficient analgesic, anti-rheumatic, and antipyretic. The clinical histories of six cases are reported.—*Therapeutic Gazette*, 1901, vol. xxv., p. 729.

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**Renal Tension and its Treatment.**—Dr. Reginald Harrison first drew attention to the fact that some cases in which the patient suffered from albuminuria and other renal symptoms that might have been produced by a stone or other removable causes had completely recovered after an exploratory operation on the kidney by puncture or incision, although no calculus or recognizable cause was discovered. This observation led by natural steps to a further generalization that tension might be an important factor in the production of some forms of renal disease. This deduction he finds to be corroborated by the testimony of many modern writers, and he draws certain analogies between the effects of intra-ocular tension in glaucoma and its effects on the retinal nerve cells and the effects of increased renal tension on the kidney parenchyma. However capable of gradual distention the kidney capsule may be, he believes that without doubt it is very intolerant of sudden increases of intrarenal tension, and experience gained by operation on the kidney has taught him that in certain conditions of congestion the capsule is so tightly stretched and its substance exposed to such pressure as quite to explain any interference with its function. Direct surgical intervention is therefore of value in such cases, and the problem arises as to

the type of cases to be chosen. These are in kidneys that are acted upon by occasional irritants derived from various infectious conditions, notably scarlet fever, diphtheria, measles, etc., and from alcohol and food intoxications. Not all of these require surgical intervention. The author considers three types of patients with acute nephritis which respond differently. In the first, a common type, there are varying degrees of rash, fever, and desquamation, with nephritis as indicated by blood in the urine, albumin, casts, and epithelium. The tendency is toward recovery, and surgical intervention is not to be countenanced for a moment. A second group, allied to the first, does not end in the same manner. In these convalescence is delayed and the signs of nephritis do not disappear. The disease does not progress toward recovery, but is stationary, or tends to become worse. Surgical intervention is applicable to these. The third type is allied to malignant scarlatinal nephritis. Here the acute, overwhelming process of intoxication with suppression of urine and uræmia, coma, convulsions, and death are correlative with great tension, as evidenced post-mortem. These cases are also to be considered as amenable to surgical treatment. The author advocates incision of the capsule for the relief of these kidneys. The patient is placed in the lumbar nephrotomy position. The kidney is exposed by an oblique incision, and its capsule opened, preferably along the convex border. Occasionally local signs of congestion may determine a different location for the incision. Simple punctures may be of service also. Drainage is essential in the after treatment, and permanent fistula is not to be dreaded.—*British Medical Journal*, 1901, No. 2129, p. 1125.

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**The Effects of Lead upon Lead-workers in the Staffordshire Potteries.**—Dr. Frank Shufflebotham describes a systematic examination which he made of 528 people who are employed in lead processes among 6000 or 7000 workers in the Staffordshire potteries. As a result of his studies he comes to the following general conclusions: 1. That of the 528 persons working directly with lead processes he did not find one marked case of lead-poisoning; 2, that individual symptoms which at first sight might have been attributed to lead-poisoning were found, on closer examination, to be from other causes; 3, that the health record of the lead-workers was excellent (the complaints he mentions being for the most part only minor ailments). Of 348 men, 196 had not lost a single day's work through ill-health from any cause whatever since they commenced to work in lead, and the same may be said of 90 out of 124 single women; 26 out of 55 married women had only been absent through confinements; 4, that the general condition of the work-people was good and would compare favorably with a like number of workers in any average healthy trade; 5, that the 91 operators who had worked in lead for over twenty years were not suffering any ill effects from their employment, although they had worked for years under practically no regulations; 6, that it must always be remembered that lead-workers are subject to ailments of life just in the same ways as other people.—*Lancet*, 1901, No. 4078, p. 1109.

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**Hay Fever and Aristol.**—Dr. E. Fink, after a thorough discussion of the various theories concerning the etiology of hay fever, concludes that Helm-

holtz's theory of a bacterial origin of the disease is nearest the correct one. The bacteria find their lodging-place in the various facial sinuses and are dislodged therefrom only with difficulty. The author blew aristol powder into the antrum of Highmore and obtained excellent results.—*Deutsche med. Wochenschrift*, 1901, vol. xxvii., p. 805.

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**Poisoning by Oleander.**—Dr. S. Wateff writes that this common ornamental plant so widely used for household decoration is occasionally used in the form of a leaf decoction as an abortifacient. Gastro-intestinal irritation, nausea, vomiting and slow pulse were symptoms observed in a case reported. Poisoning from the odor alone is here reported as having occurred.—*Deutsche med. Wochenschrift*, 1901, vol. xvii., p. 801.

[The active principle of oleander is well known as oleandrin (nerein), an active glycoside allied to digitalin in its action.—R. W. W.]

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**Quinine Rash.**—Dr. H. C. Wood, Jr., reports a case of quinine rash, and gives in addition a complete summary of modern literature bearing on this subject.—*Therapeutic Gazette*, 1901, vol. xvi., p. 8.

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**Epilepsy and its Treatment.**—Dr. W. H. Broadbent bases his practice with regard to the treatment of epilepsy on the idea that the use of the bromides is to diminish the frequency and the severity of the fits, while the cure of the disease, the removal of the instability of the nervous system, is to be sought by other means. Occasionally the instability of the nervous system may be due to some visceral irritation, especially perhaps ovarian, and protection from this by the diminished sensitiveness to external impressions, which is produced by the bromides, may allow the nerve centres to gain their equilibrium or give time for the subsidence or the removal of the disturbing influence. He gives a number of rules which may be summarized. In long existing epilepsies, bromides are not given regularly, but only when some indication of over-excitement, such as restlessness or insomnia, are manifest. If the attacks occur punctually at definite long intervals, a short, sharp course of bromides preceding is advocated. If certain premonitions are recognized by the patient as regular precursors of the attacks, bromides may be taken to advantage. When the attacks are frequent, it may be necessary to give the bromides continuously in doses sufficient to afford relief. A fruitful subject for inquiry is to be found in the nocturnal attacks or in those that occur on rising. Here the author believes there is cardio-vascular instability which reacts on the nervous instability. For these hot beef-tea or hot milk may be given at bedtime, or, in the case of morning attacks, such stimulants may be taken immediately on awakening. The author prefers food to drugs ; but food failing, a dose of digitalis or other cardiac tonic may be given at night or in the morning. A careful regulation of the mode of life is considered as essential as drugs, if not more so. General discipline is paramount. Functional derangements should be overcome or corrected. He asks, after all is done, can anything be done to improve the stability of the nervous centres by such remedies as are known to be of service when the nervous tone has been impaired or when the functional activity of the brain has been disturbed by conditions of the circulation?

For such, phosphorus and the hypophosphites, or arsenic, with strychnine, and sometimes iron, are recommended. In many instances the cessation of the bromides has achieved excellent results.—*British Medical Journal*, 1902, No. 2140, p. 1.

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**Iodic Purpura.**—Dr. Alfred Stengel calls attention to a rare manifestation of chronic iodic intoxication. The familiar acne is very common, but purpura is a rare complication. He reports in detail the histories of patients who suffered from this complication. There was marked fetid breath, soreness and some sponginess of the gums, tremor of the extremities, with great moisture of the skin, rapidity of the heart's action, and swelling of the thyroid gland (symptoms which drew attention to the possible occurrence of Graves' disease); these symptoms accompanied the marked purpura. The eruption invaded mainly the leg below the knees. There were dark blue patches of discoloration. In other spots the color was rose-red and the eruptions were clustered in clumps.—*Therapeutic Gazette*, 1902, vol. xxvi., p. 1.

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**Treatment of Tabes.**—Dr. R. T. Williams has given a valuable critical review of the recent work bearing on this affection, from which the following notes on treatment may be excerpted: The value of anti-syphilitic treatment has been much discussed. In well-advanced cases it is usually of no service; but some instances are on record in which it has appeared to bring about some improvement. In all cases in which there has been syphilitic infection only a comparatively short time before the onset of the tabetic symptoms (five years, Collins) anti-syphilitic treatment should be employed at first. It should likewise be given when any evidences of syphilitic disease are present, or when the diagnosis is not quite clear between syphilitic pseudo-tabes and true tabes. Further, when the patient has not had any antisyphilitic treatment for the tabes it is well to give it a trial (as Gowers recommends), in order that no complaint may be made later that any method of treatment has been omitted that might have been of service. Gowers and Taylor recommend *liquor arsenicalis*, and think that it brings about some improvement. Recently Motschutkowski has again strongly recommended the suspension method which he introduced in the treatment of tabes. He has employed it in 993 cases and has observed improvement in 207. The improvement was apparent in the gait, the muscular tone, the muscular sense, the paræsthesia, neuralgic pain, sexual power, bladder functions, and the general condition. The patient should be suspended at least one hundred times; the duration of each suspension being from one-half to five minutes, and should be carried out three to four times per week. One patient was suspended between four and five hundred times, and another over a thousand times. Chipault and Bardesco have recorded cases showing the value of stretching of the posterior tibial nerve in causing perforating ulcers to heal. Crocq employed faradism in one case and obtained good results. A small electrode was placed on the posterior tibial nerve behind the internal malleolus, and a larger one on the sole of the foot just behind the ulceration; a strong current being passed through the parts. After three weeks' treatment the ulcer became distinctly smaller, and in six weeks was

healed. The greatest advance in the palliative treatment of tabes is Fränkel's method of re-education of the movements of ataxic limbs. There can now be no doubt that the ataxia of tabes can often be greatly diminished by this system of careful training, in which the patient performs methodically co-ordinated muscular exercises, and by repeated practice learns to perform definite movements with care and precision. Even in severe cases of ataxia good results may be obtained. In carrying out the treatment, however, over-exertion should be avoided. As a rule, these exercises should not be performed while the patient is undergoing bath treatment; and Fränkel recommends massage of the muscles during the course of treatment. The exercises should be performed two or three times a day. For the arms special apparatus is necessary, but for the legs no special appliances are required. Muscular exercises of the legs are performed first while the patient is in the recumbent position; then exercises are carried out in the sitting posture and while standing, and, finally, walking exercises are practised. The movements are so arranged that care and precision are needed in carrying them out. Objects are touched by the toe or heel; and, in the walking exercises, lines are drawn on the floor and careful movements mapped out. The treatment is carried out at many special institutions on the Continent, and much time and patience are necessary.—*Medical Chronicle*, 1901, vol. xxxiv., p. 433.

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**Diphtheria Antitoxin Eruptions.**—Dr. Arthur Stanley reports the observations made on a series of 500 cases of diphtheria during two years' work in a diphtheria ward at the Northwestern Hospital, London. All the cases were treated by antitoxin. The total number of deaths was 80, a death-rate of 16 per cent. The antitoxin was prepared at the laboratories of the Royal College of Physicians and Surgeons in London, and was injected in amounts usually of 4000 Behring, varying, however, according to the severity of the case from 1000 up to 30,000 units. There was no constant relation between the quantity of antitoxin given and the frequency of eruption. In this series of 500 cases, 112 patients had eruptions. Of these 58 were erythematous in character; in 15 there was combined erythema and urticaria; in 30 the eruption was an urticaria, 6 were scarlatiniform, and 3 morbiliform; in 17 patients there was a transient early erythema and an urticaria, usually at the seat of the injection. Thus the skin eruptions appeared in about one-fourth of the patients The period of onset was usually during the second week after the giving of the antitoxin. The typical diphtheria antitoxin eruption is a marginate erythema on the psoriasis regions, tending to run in arcs of a circle, lasting about three days, and accompanied by slight malaise and a rise in temperature of about 3° F. The margins of the erythema are raised and turgid. The spread of the rash is most frequent from face and trunk to limbs, and from flexor to extensor surfaces. The eruption lasts from two to five days, but may, in cases of an urticarial or scarlatiniform nature last a few hours only. Sometimes the rash is general. Desquamation may occur. The occurrence of the rash did not appear to influence the course of the disease either favorably or unfavorably.—*British Medical Journal*, 1902, No. 2146, p. 386.

# GYNECOLOGY.

UNDER THE CHARGE OF

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OF NEW YORK.

ASSISTED BY

WILLIAM E. STUDDIFORD, M.D.

**Statistics of Uterine Cancer.**—WALDSTEIN (*Centralblatt für Gynäkologie*, No. 50, 1901) from a careful analysis of the record of Schanta's clinic finds that a little over 14 per cent. of the cases of cancer of the uterus were operable. Of these, 8.8 per cent. succumbed to the operation. The writer concludes that less than 4 per cent. of all patients with uterine cancer are really cured by radical operation.

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**Dysmenorrhœa.**—MENGE (*Centralblatt für Gynäkologie*, No. 50, 1901) distinguishes two forms of dysmenorrhœa, the so-called idiopathic, which is independent of pelvic disease, and the "secondary" which is due to disease of the genital tract. The writer believes that painful menstruation, from whatever cause, is referable to the tendency to uterine contraction which is present at the time of the monthly period. These are due not only to the premenstrual swelling of the endometrium described by Fritsch, but also to the mere presence of blood within the uterine cavity, which acts as a foreign body. These contractions in healthy women are insensible. In hysterical or neurasthenic subjects, on the contrary, the uterus, though entirely normal, is hyperæsthetic and dysmenorrhœa results. Mechanical obstruction to the escape of blood, added to this hyperæsthesia, increases this pain. In diseased conditions of the pelvic organs the dysmenorrhœa is more pronounced, especially if the two former factors are also present. Hence the deduction: Normal menstruation, as well as dysmenorrhœa, is accompanied by pains simulating labor-pains, although the latter may be entirely of nervous origin. It follows that local treatment alone is not sufficient to insure permanent relief, but the general nervous condition of each patient must be carefully considered.

The writer rejects the theory of a reflex nasal origin of dysmenorrhœa. Though he has seen some brilliant results from cocainization of the nasal mucous membrane, he is inclined to regard this as principally an application of the method of suggestion.

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**Fibromyoma in Cul-de-sac of Douglas.**—ROSENSTEIN (*Centralblatt für Gynäkologie*, No. 50, 1901) reports a case of tumor in Douglas' pouch, which was diagnosed as an ovarian cyst with twisted pedicle. On opening the abdomen a fibromyoma was found behind the uterus with a pedicle, which was attached to the right side of the cul-de-sac. There were numerous intestinal adhesions. The writer inferred that the growth developed

from the smooth muscular fibres of the sacro-uterine ligament, and could find no similar case on record.

[Several years ago we reported a case of fibromyoma, which sprung from the under surface of the sacro-uterine ligament and grew downward into the posterior vaginal fornix, so that it was easily removed per vaginam. It seems possible that the tumor in the case above mentioned may have been an aberrant, or migratory, fibromyoma of the uterus.—ED.]

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**Parametritis Posterior.**—BRÖSE (*Zeitschrift für Geb. und Gynäkologie*, Band xlvi., Heft 1) reports ten cases in which, after a long course of unsuccessful treatment, ventrofixation was performed. In five cases a pure parametritis was found, the peritoneum not being affected; in two the disease of the adnexa was mistaken for parametritis. Seven patients were cured; in one case there was a recurrence, and two were failures.

[The writer states that the uterus was anteflexed, which leads one to ask whether tenotomy of the shortened sacro-uterine ligaments previous to ventrofixation of the uterus would not meet the indication more perfectly. This we have done in several instances with satisfactory results.—ED.]

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**Influence of Pregnancy and the Climacteric on the Ultimate Results of Operations for Cancer.**—HEVSE (*Centralblatt für Gynäkologie*, No. 51, 1901) collected 122 cases in which the cancerous uterus was removed during pregnancy or the puerperium. Eighty-two of these were selected, in which at least five years had elapsed since the operation, but only 41 of these were suitable for comparison. Of these a radical cure was obtained in 24 per cent. Of 73 cases of hysterectomy for cancer in patients who had passed the climacteric, 50 per cent. were cured. These statistics would seem to show that pregnancy has an unfavorable influence on the prognosis, while the reverse is true of the climacteric.

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**Indications for Operation in Chronic Salpingitis.**—LEGUEN (*Revue prat. d'Obstétrique et de Gynécologie*, No 9, 1901) recognizes three indications for operation, viz.: 1. The general condition of the patient, especially in the presence of fever and constitutional symptoms; 2, the local condition, *i. e.*, well-marked enlargements of the adnexa, or fistulous communications with the bladder or rectum; 3, severe and persistent pain, which is not relieved by treatment continued for several months.

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**Enlargement of the Inguinal Glands in Cancer of the Viscera.**—VINAY (*Lyon Méd.*, No. 38, 1901) lays considerable stress upon this condition as a diagnostic sign of cancer of the pelvic and abdominal viscera. It is most frequently observed in the former class of cases. He distinguishes three forms of glandular enlargement, viz., simple inflammatory or pre-cancerous, metastatic, and inflammatory resulting from infection of ulcerating cancerous growths. This infection may follow the course of the direct lymphatics, as in cancer of the uterus, or may be carried through the superficial lymph-vessels from the umbilicus, when disease of the abdominal viscera has extended to the parietes. The glands are at first hard, movable, and painless, then they become adherent and painful in consequence of repeated

attacks of inflammation. The enlargements are usually unilateral, or are unevenly developed on the two sides. The differential diagnosis from bubo, gumma, and incarcerated hernia is sometimes difficult. This enlargement of the glands is of great importance, as it is sometimes the first evidence of malignant disease. The prognosis is unfavorable, since it denotes the extension of the primary trouble.

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**The Lymphatic Glands in Cancer.**—COVDRAY (*Revue prat. d'Obstétrique et de Gynécologie*, No. 9, 1901) concludes an extended paper on this subject by expressing doubt as to the advisability of extirpating glands which are apparently healthy, the cancerous growth being in an incipient stage. Glands which are enlarged and non-adherent should always be removed; if adherent, their ablation is usually fraught with danger to the patient. Theoretically, exposure of the open lymphatics favors fresh infection; but practically there is as yet no method of operation which avoids this danger.

The writer suggests what he calls the "sclerogenous" method, which aims at closure of the lymphatics in the neighborhood of the tumor by making numerous injections of chloride of zinc around the growth. He reports a case of scirrhus of the breast in a woman, aged fifty-eight years, five years after treatment by this method. Nothing remained of the original growth but a small, hard nodule. Five years later the cancer had recurred, with enlargement of the axillary gland. He infers that in a certain class of cases the growth of circumscribed cancer can be arrested for a long period by the artificial production of fibrous tissue around the growth, which causes obliteration of the lymphatics. This treatment is especially applicable to patients who refuse a radical operation.

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**Spasms of the Clitoris in Tabes.**—KÖSTER (*Münchener med. Wochenschrift*, No. 5, 1901) describes a peculiar localization of the crises in females affected with locomotor ataxia, first mentioned by Charcot. They appear early in the disease and are associated with the usual lancinating pain in the limbs. The spasms of the clitoris occur at frequent intervals and may be accompanied by ejaculations of mucus, or by spasms of the *constrictor cunni*, without pleasurable sensations.

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**Treatment of Bartholinitis with Salicylic Acid.**—REYGASSE (*La Revue Médicale*, Heft 17, 1900) reports a series of cases in which he injected into the inflamed gland seven or eight drops of a saturated alcoholic solution of salicylic acid. The patient experienced a sharp pain, which soon subsided and was not followed by any unpleasant results. Within five or six days the swelling had entirely subsided. A second injection is rarely necessary.

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**Gonorrhœa and Marriage.**—ZEISSL (*Wiener med. Presse; der Frauenarzt*, September 20, 1901) replies to the question "When may a man with gonorrhœa marry?" that this is allowable only when repeated clinical and bacteriological examinations give an absolutely negative result. The absence of gonococci in the secretions is not sufficient, but the patient must still be kept under observation until he is beyond suspicion. The presence of opalescent threads in the urine show that the discharge has probably ceased to

be infectious. This opinion is strengthened if only a few round epithelial cells are seen under the microscope. If diplococci are found, even though these do not grow in cultures, the innocent character of the secretion cannot yet be inferred. If no additional information can be obtained by the use of the endoscope, the writer recommends that the patient should use an irritating injection of nitrate of silver and drink beer frequently. If a free discharge from the urethra appears, and at once ceases spontaneously and no gonococci reappear, the patient may be regarded as cured.

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**Complications and Degenerations of Fibroid Tumors of the Uterus.**—NOBLE (*American Journal of Obstetrics*, vol. xliv., No. 3) makes an interesting analysis of 218 cases operated upon for fibromyoma uteri. Complications and degenerations were encountered in 126 cases. In 71 of these cases the conditions were such as, without operative interference, would have led to the death of the patient. Of the fatal complications and degenerations 32 were of the tumor, and 39 of the appendages. In 25 cases the complications were such as to threaten the life of the patient, and in 30 cases led to more or less permanent invalidism. It is estimated that without operation 78 of the cases would have died of the complications or degenerations of the fibroid tumors. Added to this 15 patients would probably have succumbed to conditions produced by the tumors themselves, viz.: hemorrhages, chronic anæmia leading to degeneration of heart and kidneys, pressure of the ureter and bowels, etc. The author concludes that had this series of cases remained without operation there would have been an estimated mortality of 42 per cent. Comparing this with the mortality from operation of from 2 to 10 per cent., early removal of the tumors seems undoubtedly to be the proper treatment. Such removal not only lessens the mortality, but eliminates the long period of invalidism that is otherwise unavoidable.

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**Migrated Ovarian and Parovarian Tumors.**—EDEBOHLS (*Medical Record*, vol. lviii., No. 7) reports four cases of ovarian and parovarian tumors that had become detached from their original connection with the broad ligament. In Case I. the tumor presented all the characteristics of a parovarion cyst, but no trace of its former attachment could be found, both tubes and ovaries being normal. It was attached by a pedicle 10 c.m. wide to the lower free edge of the omentum, and at the time of operation was gangrenous. Case II. was operated upon four days after the onset of symptoms of strangulation of a large parovarian cyst. The tumor was found free in the abdominal cavity. The left tube and ovarian ligament had been completely torn from the uterine cornu and were found on the stump of the cyst-pedicle. The author concludes that had the patient survived without operation the tumor would have taken on new attachments and formed a true migrated tumor. That this conclusion is justified seems to be proved by Case III. The patient had an intraligamentous cyst on the right side; the left ovary was absent, and the left tube, with the exception of a twisted stump, 2 cm. long at the extreme end, was missing. Attached to the posterior aspect of the uterus and a portion of the left broad ligament was a firm membrane of irregular thickness. This was removed, and on subsequent examination proved to be part of the sac of a former ovarian cyst. Case IV. had a large monocyst of the left ovary. The

right ovary and all but 2 cm. of the right tube were absent. The lower border of the omentum was enormously thickened and was wrapped completely around a tumor 15 cm. in diameter. On enucleation this was found to be a dermoid of the right ovary containing teeth, hair, and sebum.

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**New Formation of the Female Urethra.**—NOBLE (*American Journal of Obstetrics*, vol. xliii.) reports a case in which eleven unsuccessful operations had been performed for cure of a urethral fistula. The entire wall of the urethra was destroyed, and a fistula existed involving the neck of the bladder. The situation of the urethra was marked by a strip of mucous membrane continuous above with the vesical wall. The opening into the bladder was large enough to admit the index finger. The edges of the fistula were cicatricial, and upon each side of the urethra were extensive cicatrices, probably due to incisions made at the various operations to relieve tension on the sutures. After two unsuccessful attempts to form a new urethra, owing to the extreme tension on the sutures, the following procedure was successfully carried out: In order to increase the retentive power of the bladder the urethra was elongated so that the meatus should be at the clitoris instead of at the normal site. The internal coat of the urethra was made from the mucous membrane of the vestibule and the remains of the urethral mucous membrane. This was sufficiently loosened, after parallel longitudinal incisions had been made, so that it could be united over a Sims sigmoid catheter (one-third the usual calibre). This catheter was left *in situ* for ten days. The raw surface at the sides of the urethra and over the neck of the bladder were widened. An incision was made along the inner base of the left labium minus, and the labium detached from the subjacent structure and unfolded. This flap was drawn back into the vagina, covering over the urethra and then united by interrupted sutures to the edges of the raw surface. At the anterior end of the new urethra the lateral edges of the labia minora were united, firm union was obtained, and the bladder function was restored.

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**Etiology of Movable Kidney.**—WATSON (*Boston Medical and Surgical Journal*, vol. cxlv., No. 12) conducted a series of experiments on the cadaver to determine the structures chiefly concerned in the fixation of the kidney. Twelve cadavers in which death occurred not longer than twenty-four hours previously, and in which the kidneys and their surroundings presented no abnormal changes, were used in the investigation.

After opening the abdomen downward traction was made by the finger tips upon the upper pole of the kidney with as little disturbance as possible to the neighboring tissues. The descent of the organ was from half an inch to an inch and a half. The outer leaf of the mesocolon was then divided and the colon and other viscera overlying the kidney were drawn inward. The descent of the kidney under traction was now increased by half an inch. Next, the fatty tissue in front of and beneath the lower end of the kidney was removed, but with no appreciable effect upon its mobility. The removal of that portion of the peritoneum which on the right side forms an actual peritoneal investment of the upper portion of the kidney, and is reflected from it onto the duodenum and stomach, permitted a further descent of a

quarter to half an inch. Thus, after removal of all the structures in relation with the anterior surface and lower end of the kidney, the descent of the organ had not exceeded the lowest point of its normal excursion by more than three-quarters of an inch in any case.

The structures connected with the posterior surface and upper pole of the kidney were now broken down, beginning above the upper pole of the organ. Further descent occurred in direct proportion to the destruction of these tissues, the movement finally becoming entirely free except for the restraint exercised by the main bloodvessels, whose action drew it toward the spinal column. These experiments seem to harmonize with the anatomical studies of Gerota and others, and the author comes to the following conclusion: The structures vital to the restriction of the kidney's mobility within its normal excursion are those which form the attachments between the posterior and upper aspect of the tunica propria, and the fascia covering the lumbar muscles and the peritoneum covering the diaphragm respectively, aided by the less essential ones connecting the anterior surface with the peritoneum overlying it.

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## OBSTETRICS.

UNDER THE CHARGE OF

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**Three Successful Cæsarean Sections.**—KERR (*Medical Press*, November 6, 1901) reports three successful Cæsarean sections in the Glasgow Maternity Hospital. He prepares the patient by thorough aseptic precautions, scrubbing the cervix and vagina with lysol, 1 per cent. In each of the cases labor was in progress and each patient was sterilized by tying the Fallopian tubes in two places and dividing them between the ligatures. In one case sterilized silk was used to close the womb, and in the other two catgut. Elastic tubing was not used to control the bleeding, but a vulcanite ring was employed to prevent hemorrhage when the uterus was opened.

His first case was that of a multipara in her third pregnancy, her other labors having been terminated by craniotomy. The os was fully dilated and the membranes ruptured, but the pelvis was contracted and the head freely movable above the brim. This patient's convalescence was interrupted by a severe bronchitis, occasioned by the irritation of chloroform, and also of coal-gas with which the building was lighted. The patient and her child made a good recovery.

The second case was a primipara with contracted pelvis. The child was dead, and no trace of heart action could be discovered. The patient made a good recovery, but had very scanty lochial discharge and a somewhat

rapid pulse. When this patient was admitted to the hospital the heart sounds were strong and distinct, but through an error the operation was delayed three hours after admission. The child perished during this time.

In the third case the uterus grasped the child so firmly at operation that the lower end of the uterine incision was slightly torn in delivering the fœtus. This patient had one rise of temperature during her convalescence, which soon subsided.

Kerr believes that craniotomy should be positively declined when the child is living and in good condition. He believes that sterilization should not be practised, because the mortality is now not sufficiently great to prevent a repetition of the operation if necessary. He believes that it is well to select the time of operation to have the circumstances favorable. It is important not to wait until the lower uterine segment has developed, because this is readily torn and easily infected. The placenta in each case was on the posterior wall of the uterus and the Fallopian tubes were close together upon the anterior wall. In the Fallopian tube tissue excised decidual cells were not found.

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**Puerperal Tetanus.**—In the *Indian Medical Gazette*, vol. xxxvi., No. 5, 1901, KEDARNATH DAS reports the case of a Hindoo woman delivered at full term of a living child. On the tenth day the infant was seized with trismus neonatorum, and died within twenty-four hours. The mother developed tetanus, and was admitted to a hospital. She was treated by washing out the uterus with an antiseptic solution, with the free use of chloral by rectal injections and by hypodermoclysis. The spasms continued six weeks before the patient began to grow essentially better. An abundance of liquid food was given and the bowels were kept open regularly. During her illness the patient received 8 ounces, 6 drachms, and 10 grains of chloral hydrate. Das has collected 68 cases of puerperal tetanus, showing a remarkably small percentage of recovery. He could find but five recoveries, giving a mortality of 92 per cent. There were 21 cases treated by antitoxin, given either by subcutaneous or intracerebral injections. Of these but one recovered, a mortality of 95 per cent. Among these cases of tetanus but 4 occurred in India, where the disease does not seem to be common. One of these recovered, giving a mortality of 75 per cent.

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**Prolonged Retention of the Fœtus During Labor by the Enormously Dilated Cervix.**—RAPIN (*La Semaine Médicale*, November 13, 1901) reports the case of a primipara, aged twenty-five years, who was suffering from a tedious labor. The head came down into the pelvic cavity and upon the pelvic floor, when the attention of the midwife was attracted by a tumor situated between the symphysis and the umbilicus. The descent of the head ceased and assistance was summoned. On examination the pelvis was found somewhat contracted in its antero-posterior diameter. The head was in the pelvic cavity, the smaller fontanelle obliquely and toward the left. The fœtal heart sounds were not heard, and upon the presenting portion of the head there was a tumor which bled somewhat. A tumor of elastic consistence was found between the pubes and the umbilicus. Thinking that this was a distended bladder, the patient was catheterized, but the tumor did not dis-

appear. The forceps were then applied, but the head could not be delivered with moderate traction. Digital examination could discover no apparent reason for the retention of the fœtus. The patient was accordingly transferred to the hospital. Upon examination there it was discovered that the two arms of the fœtus seemed engaged in the pelvis beside the head, and that if these could not be dislodged the child could not be delivered. Accordingly the fœtus was cautiously delivered by version and found to be dead and somewhat macerated. It was perfectly formed and in no way a monstrosity. Immediately after delivery there was free hemorrhage, which ceased after the expulsion of the placenta, a hot intra-uterine douche of lysol and compression of the uterus. The abdominal tumor disappeared. Upon further examination it was found that the abdominal tumor had been composed of the upper uterine segment containing the placenta. The child had been contained in the enormously distended lower uterine segment and cervix.

He also reports the case of a multipara who had had six normal confinements previously. She had a flat rhachitic pelvis. The head was presenting and fixed in the pelvis, the heart sounds feeble and irregular. Meconium was escaping from the vulva, and there seemed to be fetid gas in the uterus. It was evident that the cervix was enormously distended. The forceps were applied at the superior strait, and a male child asphyxiated was delivered. The child was resuscitated. The placenta was removed and the uterus thoroughly douched with a hot antiseptic solution, when upon examination it was found that the upper uterine segment had been invaginated into the lower. It was enormously distended.

Both of these patients recovered, which must be considered an excellent result in view of the very serious distention which was present.

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**Labor Brought on by Alcoholic Neuritis.**—LE PAGE reports in the *Comptes Rendus de la Société d'Obstétrique de Paris*, 1901, vol. iii., the case of a patient in her second pregnancy whose first pregnancy had terminated normally. In the present gestation the patient suffered severely from nausea and vomiting, and had great difficulty in walking, with much pain in the lower limbs. A physician whom she consulted ordered baths and a milk diet. She finally became much worse, with frequent pulse, elevated temperature, dry tongue, delirium, and marked and excited movements. The lower extremities were paralyzed, the feet extended upon the legs, and the hands were immobilized and flexed upon the forearms. There was no inequality of the pupils and no strabismus. The abdomen was slightly distended, and there were sordes on the borders of the gums and teeth. There was nothing abnormal about the heart and lungs and no albumin in the urine. The appearance of the patient was that of a severe typhoid infection.

The serum diagnosis was negative, and labor was induced by the introduction of an elastic bag. During the treatment of the case it was learned that the patient had used large quantities of alcohol, drinking rum very freely. The delivery was spontaneous. The patient afterward made a very tedious recovery, with atrophy of the muscles, which yielded slowly to electrical treatment. The case was a typical one of polyneuritis, undoubtedly of alcoholic origin.

**Autopsy in a Case of Pernicious Nausea of Pregnancy.**—De Ribes (*Comptes Rendus de la Société d'Obstétrique de Paris*, vol. iii., 1901) had the opportunity to make an autopsy upon a woman dying from pernicious nausea of pregnancy. The patient was aged thirty-one years, pregnant for the fourth time at about six months and much emaciated from constant vomiting. Examination was negative; her pulse was 100. She was admitted to the hospital and various means were tried to control the nausea. This failed, and she was finally delivered spontaneously of the fœtus. After the delivery the patient steadily grew worse, presenting a typhoid appearance, with sordes upon the teeth and a red tongue. She did not vomit after the uterus was emptied, but her urine was highly albuminous. Intermittent delirium supervened, followed by coma, and death in convulsions.

Upon autopsy an active secondary nephritis was found in both kidneys. The brain, the heart, and lungs presented no lesion, but the liver was greatly altered. It presented a blanched appearance, with small areas of yellow. A large infarct was found upon the lower portion, which had replaced necrotic parenchymatous tissue. The lesions were those of an active toxæmia of hepatic origin, with multiple hemorrhages. The lesions greatly resembled those often seen in eclampsia.

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**Retroplacental Hemorrhage following Traumatism in the Abdominal Region.**—De Ribes (*Comptes Rendus de la Société d'Obstétrique de Paris*, 1901, vol. iii., p. 171) reports the case of a patient in her second pregnancy at the seventh month, who struck the abdomen violently against the corner of a table. The patient fell unconscious, but speedily revived. She had severe pain at the region of the blow and could not perceive fœtal movements, and lost neither blood nor amniotic liquid. She was admitted to the hospital, and on examination the pulse was frequent and weak, the axillary temperature normal. The urine was not albuminous, and over the region of the blow there was an ecchymosis and brownish discoloration. The region was painful on palpation. Auscultation was negative, palpation also. On examination the cervix was permeable to the internal os, which was closed. The lower uterine segment was higher and distended, and the lower extremity of the fœtal ovoid could be indistinctly felt. There was no hemorrhage from the genital organs. The patient's pains continued regularly, and labor finally came on. When the membranes ruptured a large mass of blood-clot was expelled and immediately afterward the fœtal head. The child had recently died, and an autopsy upon its body was negative. The placenta was expelled, but the membranes were adherent. On exploring the uterus the membranes and some old clots were found and removed. The uterus was thoroughly douched with an antiseptic solution. On examining the placenta it was found that blood had accumulated between the placenta and the wall of the uterus throughout a considerable portion of the attachment of the placenta.

A similar case is reported by Le Page (*Comptes Rendus de la Société d'Obstétrique de Paris*, 1901, vol. iii., p. 113). This patient was a primipara, who struck the abdomen violently against the corner of a piece of furniture, causing violent pain, which disappeared after a short time. On the following day the patient resumed her usual occupation, and while her appetite

was not good, and she felt uncomfortable, she had no hemorrhage and did not seem ill. On the following morning she was taken with violent pains, and lost a large quantity of blood. On admission to the hospital no heart sounds could be heard, the patient's pulse was 80, and her temperature subnormal. She had ceased to bleed. The expulsion of the fœtus continued, and a dead but not macerated child was spontaneously expelled. The placenta and a mass of blood-clots immediately followed. The patient continued to bleed for some time after labor, but finally made a good recovery.

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**Retroversion of a Fibroid Uterus Simulating Pregnancy.**—RUDAUX reports in the *Comptes Rendus de la Société de Paris*, October, 1901, the case of a woman, aged thirty-four years, married six months, whose menstruation had been irregular since its first establishment. A few days before entering the hospital she had pain in the lumbar region, with an abundant discharge of blood, for which a midwife gave her several hypodermic injections of ergotin. On the following day, during a bowel movement, the patient expelled a considerable quantity of clot. A physician who saw her diagnosed an abortion at two months. After this the patient's condition became alarming; she had difficult micturition and severe and persistent abdominal pain, for which she was brought to a hospital. On examination the uterus was found retroverted, the posterior cul-de-sac filled by a mass the size of a large orange. A diagnosis was made of retroversion of the uterus, gravid between two and three months. The patient had a foul discharge and fever, and curetting of the uterus, with its replacement, was decided upon. When this was done it was found that the patient was not pregnant, but that upon the posterior wall of the uterus there was a sessile soft fibroid which had become infected. As the patient's condition continued to grow worse, hysterectomy was practised, followed by a fatal issue.

This case calls attention to a familiar error, the diagnosing of abortion because a patient whose menstruation has been irregular is taken with pain and hemorrhage. A positive diagnosis of abortion cannot be made, unless some portion of the embryo or its appendages is clearly identified.

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**Torsion of the Pedicle in Hydrosalpinx Complicating Pregnancy.**—In the *Comptes Rendus de la Société de Paris*, October, 1901, PINARD and PAQUY report the case of a woman, aged twenty-six years, in her second pregnancy, who suffered from severe pain in the right side, which recurred at irregular intervals. The patient vomited bile and had a chill. The examination and history pointed to a cystic tumor with twisted pedicle. Upon abdominal section the tumor was found to consist of an enlarged ovary, with hydrosalpinx, whose pedicle had become twisted. The patient made a good recovery from the operation.

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**Atony of the Uterus Causing External Hemorrhage during Gestation.**—OLIVER (*Edinburgh Medical Journal*, December, 1901) draws attention to the frequency of hemorrhage from the uterus at about the sixth week of gestation. The vessels over a localized area and the mucous lining of the uterus increase in size, forming sinuses. The wall of the womb itself grows thin and distensible. But when the maternal vessels receive the pressure of

the opposing villi, blood-pressure is maintained and hemorrhage from the sinuses prevented. If from any cause the coaptation of the villi and the uterine wall becomes impaired, then the maternal vessels may rupture and hemorrhage result. Atony of the uterus is a not infrequent condition in many ill-nourished and debilitated patients in whom hemorrhage during early pregnancy is not infrequently observed.

## OPHTHALMOLOGY.

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**The Pupil in General Disease.**—JACK, Boston (*Boston Medical and Surgical Journal*, September 26, 1901), gives a summary of the pupillary phenomena in general disease.

The afferent path of the reflex arc for light reaction is the optic nerve and tract branching by some path to the pupil-contracting centre in the floor of the third ventricle, whence the third nerve to the iris is the efferent path. The associated contraction to convergence and accommodation is brought about by the same centre near which are situated those for convergence and accommodation. The active dilating centre is the cilio-spinal in the lower cervical cord. The normal moderate dilatation is dependent upon the constant psychical and sensitive stimuli transmitted through the sympathetic to the iris—the sympathetic reflex. The eyes should be tested one at a time for the light reflex, the other being covered. The patient should look at a distance so as to avoid bringing in the associated contraction for convergence and accommodation. So long as perception of light remains the reflex will take place, but the reverse is not true—*i. e.*, the vision may be good and no contraction of the pupil occur, as in paralysis of the sphincter, for example, by a mydriatic. The pupil of the second eye will also react to light thrown upon its fellow because of the nervous connection between the two sides. A blind eye will not react to light thrown on its own retina, nor will the second eye, but both will react perfectly if light be thrown on the other sound eye. There is a rare exception to the rule that pupils of blind eyes will not react—that is, when a lesion is high up in the optic tract, as in uræmia. Local diseases of the eye and drugs internally or locally may cause anomalies in the reactions and shape of the pupil, and these must be excluded in studying the effect of general disease. Dilatation may be paralytic (third nerve) or irritative (sympathetic); so likewise contraction may be paralytic (sympathetic) or irritative (third nerve). Paralytic mydriasis

is seen in progressive paralysis (myosis at first) and in various disease processes at the base of the brain affecting the third nerve or its nucleus. Irritative mydriasis occurs in spinal meningitis of the cervical portion of the cord, in the spinal irritation of anæmic or chlorotic patients, after severe illness, as a premonitory sign of tabes, from intestinal worms, psychical excitement—acute mania, melancholia—in general paralysis, oftener then in one eye only with myosis in the other. Unilateral mydriasis occurring at short intervals, first in one eye and then in the other, is, according to von Graefe, a premonitory sign of mental derangement. Unequal pupils are said to be always pathological, but there are rare exceptions. They are said to occur in hysteria. Irritation myosis occurs in the early stages of inflammatory affections of the brain and meninges; later there is dilatation in the stage of depression. Paralytic myosis occurs in spinal lesions above the dorsal vertebræ—tabes, injuries, inflammations, etc. In acute mania, if myosis comes on, general paralysis may be prognosticated.

In the Argyll-Robertson pupil—reaction to accommodation, but not to light—the reflex arc is broken somewhere probably between the point where the optic fibres leave the tract and the nucleus of the third nerve. This is a frequent and early symptom in tabes; the pupils are usually, but not always, very small. The reaction to convergence is lost later. The same phenomenon is present in general paralysis, but less frequently, and usually later. In this disease pupillary symptoms are frequent and early, beginning usually as an inequality, the same being present in other forms of insanity. The Argyll-Robertson pupil always means the existence or approach of serious nervous disease.

Wernicke's symptom—light reflex preserved when light is thrown on the blind half of an hemianopic eye—is present if the lesion be above the reflex arc in the brain. Exceptionally the pupil may react when the lesion is in the arc, the special fibres for the reflex being perhaps more resistant than the ordinary fibres.

The paradoxical pupil symptom is the slight oscillation—hippus—which rapidly goes on to dilatation instead of contraction—considered an early sign of coming paralysis, also reported in hysteria and disseminated sclerosis. In the algid stage of cholera, if the light reflex is present the prognosis is good; if absent, bad. In epilepsy there is usually contraction first and dilatation later, the light reflex being lost—an important point in distinguishing the attack from hysteria. The writer, however, asserts that he has observed dilated and irresponsive pupils in hysteria. Both bilateral and unilateral mydriasis has been noticed in diabetes.

For diagnosis of the situation and nature of intracranial lesions the pupillary symptoms, if alone present, are of but little significance. If other branches or nerves are involved the importance may become considerable, especially considering the early period at which some pupillary changes occur.

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**Depression of the Lens in Cataract.**—Mr. Power, London (*British Medical Journal*, October 26, 1901), makes a plea for the occasional performance of this operation. After referring to the fair measure of success obtained by native itinerants in India, who practice the operation with a

total disregard of all antiseptic precautions and even common cleanliness, he thinks that a field for it exists, notwithstanding the brilliant results obtained from extraction by modern methods. The classes of cases in which he advises it are those in which conditions are present which render it doubtful whether any operation should be undertaken—for example: (1) Those who are greatly enfeebled by age and other infirmities; (2) where physical obstacles to extraction are present, *e. g.*, small palpebral fissures, small eye and deeply set in the orbit; (3) chronic conjunctivitis and dacryocystitis; (4) considerable degree of deafness; (5) in the insane; (6) chronic bronchitis; (7) fluid vitreous, with tremulous iris; (8) where extraction has been unsuccessfully performed in one eye; (9) in the hemorrhagic diathesis.

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**Paralysis of the Facial and Paralysis of the Lateral Associated Movements of the Eyeballs of the Same Side, with the Electrical Reactions of the Affected Muscles.**—PECHIN and ALLARD, Paris (*Gaz. Heb. de Med. et de Chir.*, August 29, 1901) insist that paralysis of the associated lateral movements of the eyeball alone or accompanied by other palsies, as a rule, presents great difficulties in diagnosing the situation of the lesion, due in part to the fact that our knowledge of the co-ordinating centres of the ocular globes is still imperfect. When the paralytic phenomena appearing to be due to an organic lesion show departures from the usual clinical picture, and, besides, the patient is an hysterical subject, the difficulty of determining the syndrome becomes very great. They report the following case:

Female, aged forty-six years, married, has suffered from hysteria and also true mental disturbance. About a year and a half before coming under the authors' observation she experienced sudden disturbance of vision, with deviation of the angle of the mouth. She continued to have frequent nervous crises, with visual and auditory hallucinations. Examination showed complete facial palsy on the left side. The skin of the forehead and cheek perfectly smooth; the left eye more widely open than the right; the mouth is slightly deviated to the right and drawn downward; the frontalis and orbicularis palpebrarum completely paralyzed on the left side; the left eye cannot be perfectly closed—during sleep a portion of the globe is exposed—but in spite of such partial lagophthalmia there has been no neuroparalytic keratitis; no epiphora; slight deviation of the tongue and uvula to the left (the paralyzed side).

Electrical examination gave the following results: No modification in the limbs and trunk; in the face considerable augmentation of faradic and galvanic irritability of the nervous trunk of the facial, of its three branches, and of all the muscles of the face. Diminution of the cutaneous sensibility to faradization.

Frequent headache, buzzing in the ears, especially in the right; hemianæsthesia of the left side, extending to the face; pharynx anæsthetic; ovarian spot on the right side.

Gait peculiar, spasmodic. She scrapes the ground with her feet, the latter hardly raised. Knee-jerk normal; reflex of the fascia lata preserved; Babinsky's sign absent.

Ocular conditions: Paralysis of the lateral associated movement upon attempting to look to the left. The eyeballs do not pass the middle line

Recently a modification has taken place in the right eye—slight adduction, with nystagmiform movements. The left eye always stops in the so-called primary position. There is no abduction. Convergence is preserved. When the patient closes the right eye and fixes a line drawn upon a sheet of white paper she quickly has diplopia followed by polyopia. There is besides colored vision. A black line appears bordered with a red and yellow margin; she sees intermittently two superposed rainbows. This monocular diplopia with disturbance of the chromatic sense was always present at repeated examinations.

Cornea completely anæsthetic to touch, with diminished sensibility of the conjunctiva, both palpebral and bulbar, of the left eye.

The visual field seems contracted, but the examination is very difficult because of the patient having a nervous crisis at every attempt at examination. This crisis is characterized by pain in the forehead, followed by contraction of the upper extremities; the head is thrown backward. It terminates by yawning and hiccoughs. It can be stopped by striking the sides of the neck with the hand. The crisis appears both when the attention is fixed and by electrifying the frontal region.

Fundus of the eye normal; no optic neuritis; no amaurosis; no amblyopia.

As to the seat of the lesion causing the ocular and facial paralysis, after excluding an hysterical, a peripheral, nuclear, and cortical origin, the writers conclude that the palsy is due to a lesion seated in the corpora quadrigemina or their neighborhood—the co-ordinating centres of the associated movements; these centres are extra-nuclear, supra-nuclear. The lesion is one of pressure, of doubtful nature, perhaps tubercular, involving the posterior longitudinal fibres. A lesion situated there would explain both the facial and ocular palsies.

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**Ocular Complications of Smallpox.**—M. DUFOUR (Lausanne) finds that some ocular lesion occurs in from 10 to 15 per cent. of all cases of smallpox. In the majority of these it is a conjunctivitis, but in about 30 per cent. of the ocular cases the cornea is involved. Next in frequency to the cornea the lacrymal apparatus is liable to suffer. He reports a case in which on the twelfth day of the eruption the cornea became involved, an abscess formed, and it seemed as though useful vision would be lost. Subconjunctival injections of a solution of corrosive sublimate 1 : 2000 were practised at intervals of two or three days, with instillations of atropine. The corneal disease was promptly checked, and the eye recovered with a partial leucoma, numerous synechiæ, and vision equal to counting fingers at 3 metres, which might be improved by a subsequent iridectomy.

J. COURMONT and ET. ROLLET (Lyons) have encountered forty-five cases of involvement of the conjunctiva or cornea in 691 cases of smallpox. They have resorted to instillations of a solution of methylene blue, 1 : 500, repeated several times a day, to abort these ocular lesions. They regard the value of this treatment in preventing a permanent damage to the eye from variola as equal to that of the Credé method of using solutions of silver nitrate for the prevention of blindness from ophthalmia neonatorum. They regard the corneal affection as a specific process not dependent on the ordinary pyogenic organisms.—*Annales d' Oculistiques*, May, 1901).

**Optic Atrophy Due to Mumps.**—H. Dor (Lyons) reports two cases of optic atrophy following mumps, in which no other probable cause could be discovered. In one the visual disturbance was not noted for several months after the attack of mumps. In the other vision was markedly reduced in one month, and two months later the case had gone on to advanced atrophy. —*Transactions of the Thirteenth International Medical Congress.*

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**Iritis and Keratitis Due to Mumps.**—A. Pechin (Paris) reports the case of a young recruit who suffered a severe and prolonged attack of mumps which began the middle of February. When the patient left the hospital on April 6th there was still considerable swelling of the parotids. The latter part of April he noticed impairment of vision and redness of the eyeball, but without pain, photophobia, or excessive lacrymation. When seen the last of May there was well-marked iritis in both eyes, with some corneal infiltration in the right. Under general treatment, with atropine and hot compresses to the eyes, there was slow improvement, with restoration of full vision in the left, and V. 1/2 in the right.—*Recueil d'Ophtalmologie*, June, 1901).

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**Ocular Mumps.**—Under this title, Sendral, Physician-Major in the French Army, gives a general review of the eye lesions that attend this disease. The most common is inflammation of the conjunctiva, with a strong tendency to chemosis, but with very little discharge; it is often accompanied by œdema. In a certain proportion of cases the cornea participates in the inflammation.

The lacrymal glands are liable to involvement along with the salivary glands, presenting an inflammation of much the same character.

The optic nerve may be the seat of congestion or pronounced inflammation, with temporary impairment of vision, and in rare cases this condition may be followed by optic atrophy. (See Dor's case above.) He finds that these ocular complications are much more likely to arise in adults than in children.—*Recueil d'Ophtalmologie*, February, 1901).

[The ocular complications of mumps are probably more common than is generally realized, the involvement of the conjunctiva along with other mucous membranes being the only one usually mentioned in descriptions of this disease. The fact that mumps frequently occur without the nature of the attack being recognized, and even without the patient coming under the observation of a physician, is a reason for special care not to overlook this origin for obscure disease of the eyes.—Ed.]

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**Metastatic Ophthalmia in Pneumonia.**—P. Petit (Rouen) reports a case of bilateral conjunctivitis, and serpiginous ulcer of the right cornea, and panophthalmitis of the left eye. The patient, a woman seventy-nine years of age, had been sick for two weeks before entering the hospital. She came with both lungs somewhat involved, although the principal lesion was in the base of the right. Ten days later there was a conjunctivitis, with moderate discharge, and the cornea of the right eye became involved. One week after that the left eye exhibited œdema of the lids, exophthalmos, chemosis, haziness of the cornea, and slight hypopyon, tenderness of the globe and increased

tension. Vision was reduced to light perception. Subsequently the right cornea perforated, but in the left eye the inflammatory symptoms subsided. The patient died six weeks after admission to the hospital.

The case appeared to be one of general pneumococcus infection, this microorganism being found in the various lesions, both pulmonary and ocular.—*Annales d' Oculistique*, September, 1901.

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**Postpartum Metastatic Panophthalmitis.**—W. L. PYLE (Philadelphia) reports a case of this now rare disease.

The patient had a prolonged labor and instrumental delivery, followed by severe pain in the abdomen, high fever, and delirium. On the tenth day the right eye became inflamed and continued in that condition. When the patient was first seen, two and a half months later, although the cornea was clear and the iris not greatly altered in appearance, the eye was already atrophic. On microscopical examination it was impossible to determine whether the processes had originated in the choroid or retina and no microorganisms were detected by the Gram-Weigert method.—*Proceedings of the Philadelphia County Medical Society*, April, 1901.

[This condition, happily now rare, was far more common before the application of antiseptic principles in midwifery. J. Schöbl, in his recent article on "Diseases of the Retina," speaks of having, "concerning this eye affection, experiences as numerous as they are sad." He served in the Obstetric Clinic and in the Eye Clinic at Prague, and says: "I remember several days during which I saw daily more than twenty individuals suffering from puerperal fever, of whom four or five had metastatic eye disease."

In spite of the great change for the better, cases of the kind still occur, and there is danger in the presence of the serious primary disease that the eye complications may be overlooked or neglected—ED.]

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**Visible Blood Current in the Retinal Veins in Leukæmia.**—K. GRUNERT (Tübingen) reports the ophthalmoscopic observation of a distinct visible movement of the blood-current in the retinal veins in a case of severe leukæmia. The patient, a woman, aged thirty-eight years, showed red corpuscles reduced to about 2,000,000 and the proportion of white corpuscles increased to 1 : 2.8. Vision was good—5/6 in each eye. But severe neuroretinitis was present, each nerve entrance being covered by a swelling double its diameter, and extending six or seven dioptries into the vitreous. By close observation of the erect image there could be seen in the thicker venous trunks a distinct blood current, a fine drizzle (Rieseln), as if sand were rapidly moved in a red glass tube. The blood movement was naturally confined to the centripetal current obstructed at the papilla. In the smaller veins and in the arteries no such current was noticed. There was no appearance of pulsation.

The visible blood current has been observed with the ophthalmoscope in the eyes of fish and some of the other lower animals. The blood corpuscles in such animals are much larger than in man, and the amplification of the ophthalmoscopic image is also greater. Grunert explains the appearance in his case by the greatly increased proportion of the larger blood cells, the leucocytes, and by the fact that these larger blood cells would predominate

in the sluggish current near the walls of the vessel, while the erythrocytes would be carried by the swifter stream in the axis of the vessel.—*Centralblatt für praktische Augenheilk.*, August, 1901.

[Grunert has been unable to find in the literature any allusion to a similar observation regarding the blood current in the human eye; but such an one was published by USHER (*Ophthalmic Review*, December, 1896) among observations on the retinal blood stream at the time of death. As he describes it, "When the blood flow became visible the blood column in the vein was unbroken. The normal homogeneous appearance of the blood in the vessels became at first finely granular, and later on more coarsely granular; still later beading occurred, the red blood columns being broken up by clear gaps. There was a granular appearance in the arteries also."

The explanation offered by Usher was, "in the slowing of the circulation in the retinal vessels to such an extent as to allow the red blood-corpuscles to become visible, the larger granules being perhaps groups of red corpuscles, the smaller ones single corpuscles." The beading alluded to by Usher was similar to that which has been observed after obstruction of the central retinal artery, attended with slow movement of these comparatively large visible masses of blood along the vein toward the optic nerve entrance. It is quite different from the granular appearance, which preceded it in Usher's observation and which Grunert now describes. The full general history of Grunert's case is not given.—ED.]

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**Purulent Inflammation of the Palpebral Portion of the Lacrymal Gland, Rosenmuller's Gland.**—LOR (*La Clinique*, Bruxelles, No. 45, 1901) calls attention to the above affection which has been but rarely described. He reports five cases. The accessory lacrymal gland is contained between the two leaflets, an anterior and a posterior, of the aponeurotic expansion of the elevator of the upper lid. These two leaflets unite above with the infero-inner wall of the orbital portion of the lacrymal gland, permitting only a very narrow path of communication with the palpebral portion; below the accessory gland is in immediate contact with the conjunctiva. The latter being little resistant, any swelling of the gland or collection of liquid therein encroaches upon the palpebral fissure, obliterating the cul-de-sac. This explains why the pus tends toward the conjunctiva.

The symptoms of the affection are: an inflammatory swelling, more or less hard and painful, the size of a small bean, situated entirely in the external upper portion of the upper lid, encroaching upon the palpebral fissure; there is partial chemosis limited to the external palpebral bulbar region; a yellowish point soon appears followed by a purulent fistula; finally as negative signs, the absence of serious involvement of the eyeball as well as of all influence upon the general health. At the most there may be present a slight saburral condition of the digestive tract; there is moderate local pain, some disturbance of motion upon looking outward, with momentary diplopia. The pre-auricular gland is frequently swollen and a little painful.

The inflammation sometimes involves the orbital portion of the gland as well, exaggerating the symptoms. As regards the tears, no modification is observed in disease of this portion of the gland, unlike when the orbital portion is affected; in the latter case the tears are diminished on the affected

side, lending support to the view that the orbital portion supplies the lacrymal secretion of psychic origin.

The disease lasts from one to two weeks. It is an affection of childhood and adolescence. The treatment is medical, not demanding surgical intervention; it will be very rarely necessary to open the abscess. It is preferable to let the little collection of pus evacuate itself. Warm antiseptic lotions and cataplasms are all that is necessary.

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## DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF

J. SOLIS-COHEN, M.D.,

OF PHILADELPHIA.

**Dislocation of the Arytenoid Cartilage.**—Dr. Henry L. Wagner, of San Francisco, reports (*The Laryngoscope*, August, 1901) a case of traumatic dislocation of the left arytenoid cartilage in an elderly man, aged seventy-two years, who was struck on the neck by a drunken soldier. On regaining consciousness he was unable to speak, breathing was difficult, and he had intense pain in the region of the neck where he had been struck. Laryngoscopic examination the next day revealed an amount of swelling which rendered it difficult to trace the contour of portions of the larynx. Slight crepitation could be felt on the left side, but no abnormal motion could be perceived. A few days later, when the swollen condition had largely subsided, the left arytenoid cartilage was seen somewhat dislocated and thrown to the front of its normal position.

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**Mycosis of the Tonsils, Palate, and Base of the Tongue.**—Dr. E. Harrison Griffin, of New York, reports (*New York Medical Journal*, December 14, 1901) a case in a female school-teacher, which was eventually controlled by the combined effects of frequent tobacco smoking, avulsion of the vegetation, followed by cauterization with chromic acid, the use of a gargle of chloride of iron 3 drachms, glycerin 2 ounces, and water enough to make 3 ounces, 1 drachm of which was used as a gargle every three hours, and then swallowed.

Dr. Griffin states that he has treated more than fifty cases of this affection, all of them, as far as he remembers, in females. He suggests that the habit of smoking in the male may be the cause of preventing the development of the affection.

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**Paralysis of the Tongue.**—Dr. J. Wesley Shaw, of Springfield, reports (*The Dental Cosmos*, November, 1901) a case of tongue paralysis of dental origin in which he located the seat of the disturbance in the upper left bicuspid tooth, which had a large amalgam filling disto-approximally.

Removal of the filling and systematic destruction of the gangrenous pulp and proper refilling of the tooth cured the case in a few days. During this treatment an induced current of electricity was passed from the nape of the neck to the floor of the tongue, principally by way of diverting the patient, and is therefore not accredited as essential in the cure.

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**Lipoma of the Pharynx.**—A case of this infrequent pharyngeal neoplasm in a man, aged fifty-five years, was mentioned by MR. ROBERT H. WOODS, of Dublin (*Journal of Laryngology, Rhinology, and Otology*, October, 1901), in a discussion on tumors of the pharynx, before the British Laryngological, Rhinological, and Otological Association; and Mr. Lennox Browne referred to a case of Barnard Holt's whose patient died of suffocation while he was smoking.

The discussion, which is well worth consulting, was opened by Mr. Woods, who, after mentioning some typical instances of various morbid growths of the pharynx, detailed his methods of operative procedures, including some ingenious devices for securing loops in position for operation by incandescent section.

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**Fracture of a Gottstein Curette during an Operation for Adenoids.**—DR. CHRISTIAN R. HOLMES and DR. H. STOWE GARLICK, of Cincinnati, report (*The Laryngoscope*, May, 1901) a case in the practice of each in which the cutting portion of a Gottstein curette broke as pressure was made in the initial step of the operative procedure. In Dr. Holmes' case, operated upon under general anæsthesia, the fragment was extracted by pressing his finger upon one end of the broken blade, so that it became embedded in his flesh, enabling him to withdraw it into the mouth, whence it was removed with forceps. In Dr. Garlick's case, operated upon without anæsthesia, the fragment was swallowed and passed three days later.

These instances, though rare, would indicate that the strength of the instrument, which might be diminished by repeated sharpenings, or even be originally defective, should be well tested before each operation.

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**Rhinoscleroma.**—DR. CHARLES W. ALLEN, of New York, presented (*Journal of the American Medical Association*, December 14, 1901) at the fifty-second annual meeting of the American Medical Association a very interesting and admirably illustrated article on this subject.

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**Loss of the Cartilaginous Septum of the Nose during Convalescence from Influenza.**—DR. L. DE MILLY, of New Orleans, reports (*Revue Hebd. de Laryngologie, d'Otologie et de Rhinologie*, October 12, 1901) a case of an infant, aged five years, brought to him by its parents in consequence of a deformity of the nose. Examination showed that the cartilaginous septum had become effaced without any destruction of the mucous membrane, which was intact upon both sides.

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**Morbid Growths of the Nose.**—DR. GEORGE DESVAUX, of Angers, reports (*Revue Hebd. de Laryngologie, d'Otologie et de Rhinologie*, October 5, 1901) a case of supposed malignant tumor of the nose which was removed by several

operations with the incandescent electric snare, and which proved to be an hypertrophy of the mucous membrane of the lower turbinated body, containing numbers of capillary vessels surrounded with sarcomatous cellules.

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**Morbid Growths of the Upper Air-passages; Diffuse Papilloma in the Larynx and Trachea of a Child, Aged Four and One-half Years, and Requiring, Successively, Tracheotomy, Two Thyrotomies, and Fissure of the Entire Length of the Trachea.**—Dr. Leon Béco, of Liège, reports (*Revue Hebd. de Laryngologie, d'Otologie et de Rhinologie*, October 19, 1901) a case in an infant from whom he had removed enlarged tonsils and voluminous adenoid tumors from the vault of the pharynx. It was subsequently found that in addition to these troubles there were papillomas of the larynx in the arytenoid region. These increased in size and rendered a tracheotomy necessary. Six months later thyrotomy was performed and vegetations were found filling the larynx. They were removed with cutting forceps, bistoury, scissors, and the electric cautery. Recurrence ensued. Five months later tracheotomy, followed by thyrotomy at the same sitting, was performed, revealing two enormous papillomas in the trachea as the cause of some precedent suffocative paroxysms. The laryngeal cavity contained considerable papillomas, although less extensively than at the first operation. Five days later the trachea was incised down to the sternal notch and growths removed from several portions of its extent, since which time the patient had remained free from trouble for eleven months.

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**Vocal Nodules.**—Dr. Charles H. Knight, of New York, contributed a paper on this subject at the last meeting of the American Laryngological Association (*The Laryngoscope*, November, 1901) in which, among other things, he describes a case which developed under his personal observation. The case improved under systematic vocal exercises and daily instillations of adrenalin chloride, 1 : 5000.

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**Tuberculous Laryngitis.**—At the recent British Congress on Tuberculosis, Dr. St. Clair Thomson, of London, read a paper (*Journal of Laryngology, Rhinology, and Otology*, October, 1901) on the "Principles of Treatment of Tuberculous Laryngitis," in which he states that the statistics of the Pathological Department of the Brompton Consumption Hospital show that the larynx is affected in more than 50 per cent. of the cases which succumb to pulmonary tuberculosis. (A remarkable showing to the writer of this notice in the light of his own forty years' experience.)

Dr. Thomson deprecates attempts at topical interference, and the principal conclusions arrived at are that pathology and clinical experience show that the focus of infection is near or in the crico-arytenoid joint in the majority of cases; that many topical measures only distress the patient and hasten the progress of the disease; that any persistent suspicious laryngeal catarrh should be treated seriously on even a presumptive diagnosis; and that symptomatic treatment should be directed to an irritative, catarrhal, or obstructive condition of the air-passages. Silence should be enjoined, the disuse of the voice being proportionate to the degree in which the focus of infiltration approaches or interferes with the arytenoid joint.

# PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF
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**Recent Cell Studies of J. Arnold.**—The more recent studies of J. Arnold (*Archiv f. mikrosk. Anat.*, 1900, Band lv., p. 479–488, and *Anat. Anz.*, Band xvii., p. 517–519) turn chiefly upon the so-called *Granulalehre*, a theory of certain cytoplasmic granules. With a special technique Arnold has investigated certain general problems, such as the origin (pre-existence or importation) of the granules, their relation to phagocytosis, their value as an index or property of the cell's life. The technique is in general simple enough and the materials few; tongue, web, mesentery, subcutis, and dorsal lymph sac of the frog; warm stage, elder pith for inclusions; stains—especially methylene blue and *Neutralroth*, and a variety of inert substances—oils, iron, and the like—for injection.

A good idea of his work may be obtained from an earlier article, "Ueber Granulafärbung lebender und überlebender Leukocyten," *Virchow's Archiv*, Band clvii., S. 424. The tissues are examined alive and at various time-intervals. The effects are shown of using the stains in powder or solution, of injecting substances *intravitam* or applying them to excised tissues.

The granules apparently pre-exist as granules or as hyaline droplets. The demonstration of the granules is possible both before and after the phagocytosis of indifferent bodies, such as fat granules. The granules Arnold takes to be essential structural elements of the cells—true plasmasomes—and their staining he looks upon as a vital property. Take, for illustration, a recent experiment: Upon a frog's tongue, held in the Thoma apparatus, dust methylene blue in finely granular state; drop on 1 per cent. NaCl, cover, and watch under a microscope. In from fifteen to twenty minutes certain cells in the middle of the so-called nerve papilla assume a blue-gray color, due to fine granules of the stain as yet laid only on cell surfaces. Later, an intense fine granulation appears in the subepithelial tissue, which is gradually made out to stand in connection with fine varicose fibres. Fibres are given off which end in a small swelling below the surface. The fibres remain stained several hours.

Certain curious and unpredictable results are obtained. For instance, in the above process cells occur at the periphery of the papilla which assume the stain early. These, it may be supposed, are peculiar or perhaps moribund cells. But Arnold is as yet uncertain whether diffuse staining of either nucleus or cytoplasm means in all cases cell-death. Again, the number of granules demonstrable by methylene blue is, as a rule, smaller than by *Neutralroth*, although the number of granules demonstrable in mast-cells is larger by methylene blue.

In the mesentery the stains occur especially near the lymph paths, of which the cells have granules in their processes.

It is hard to appraise these studies which Arnold has made. Little appears to have been done by others either in confirmation or in extension of this work.

An earlier study by Arnold ("Ueber die Structur und Architectur der Zellen," *Archiv f. mikrosk. Anat.*, Band. lii., S. 134) may be interpreted as an attempt to get the solid tissues into a state wherein blood-technique may be applied to them. By maceration in Lugol's solution Arnold was enabled to isolate the most varied cells (including nerve and smooth muscle cells) and to examine them in smears. The later work takes its departure logically from the desire to obtain for the solid tissues a second advantage usually conceded to blood work—the observation, namely, of the cells alive and in process of assuming stains; hence proceeds the stress now laid upon the "vital" nature of the granule staining. It is very easy to see, therefore, that many of Arnold's articles are hard to understand by themselves, and must be thought of as ancillary to the main problem—the cytology of the solid tissues of vertebrates.—E. E. S.

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**Structure and Histogenesis of Neuroglia Tissue under Pathological Conditions.**—Bonome (*Virchow's Archiv*, 1901, vol. clxiii., p. 441) notes the dearth of recent work on pathological glia, and reports his own series of some twelve cases (including, besides gliomata, some glioses). Bonome attacks the problem after the fashion of the histologists. He wishes to do for pathological glia what has been done for normal glia, and so uses almost exclusively Weigert's differential methods. The plates recall those of Weigert's 1895 monograph.

The paper is divided into a number of sections, comprising the cytology of glioma, the distinctions between glioma and gliosis, the significance of epithelial elements in glioma, and the interrelations of cell and fibril in glia new-formation.

Gliomata are true tumors characterized by cellular richness (suggesting endothelial sarcomata), by exceeding vascularity, by tendency to necrobiosis with cavity formation, and by the absence of included nerve fibres or ganglion cells. Histologically, the cells of gliomata possess more or less embryonic characters, and resemble in turn sarcoma cells (proliferative activity marked) and ectodermic elements (proliferative activity less marked). Fibrillæ are rarely so numerous as in either normal glia or simple gliosis. In simple gliosis the fibrillæ are so numerous as to remind one of a fibrin network. The cells in gliosis are less numerous and less atypical than in glioma, for in glioma the cells seem never to have reached the embryonic stage in which epithelial and spongioblast forms have become differentiated; the cells are larger, the nuclei are more vaguely outlined, the picture is in every way more "peculiar" than in gliosis. The paucity of fibrillæ demonstrable in gliomata Bonome compares with a similar lack in three to five months' embryos treated by the same method.

Of interest on the genetic side is the finding of epithelial elements in gliomata (either lining cystic cavities or in groups or cords in a field of glia cells). Such are to be considered, according to Bonome, not as developmental errors or insignificant inclosures, but rather as instances of genuine preservation of the embryonic type, and, in particular, of the wandering

tendency which characterizes those earliest cells. To explain such heterotopia of glia cells alone one may suppose no neuroblast elements were present in the original foci, or perhaps that the differential capacity of such cells is lost and that the wandering derivations are fated at least to lie as inactive elements within the tumor—neither true glia cells nor true nerve cells. Certain cases are adduced, notably one of Stroebe's, to give color to the belief that the occurrence of epithelium in gliomata is not secondary and that, whether or no the cavities occur as lateral branchings of the central canal or in truly independent foci, the deposit of glia is secondary, that of epithelium primary.

Bonome's conclusions upon fibrils are as follows: The fibrils are chemically different from the cell-protoplasm, nor are any transitions observable in staining reaction according to the vicinity or remoteness of the fibril from the cell. The system of glia fibrils, it is a triumph of modern technique to have shown, is an intercellular (not cytoplasmic) substance. But the fibrils are probably derivatives of the cytoplasm, not sproutings from it, but chemical deposits incident to a certain stage in the cytoplasm's development. In general the earlier one catches either normal or pathological glia the fewer fibrils; glia cells of the embryonic type do not produce fibrils (how easy then to confuse tumors of such type with sarcoma!). The oldest part of a glioma will be doubtless that which contains most fibrils.

From the necessary combination of such an array of factors is easily explained the frequent absence or paucity of glia and fibrils in the neighborhood of foreign bodies, tubercles, and the like. Return to embryonic condition, over and above some stimulus, is required to yield new glia. As for fibrils, the proper stage in the cytoplasmic development may not have been reached. If new fibrils are developed out of proportion to cells present one must consider that the cytoplasm may contribute merely the differentiating element in their evolution, or perhaps the cells, exhausted in the production of fibrils, may be earlier destroyed.

In certain cases glia acts precisely like connective tissue (though always chemically to be distinguished). A plate is given to show penetration of pia by new-formed glia. Glia fibrils are distinguished from fibrin-threads not alone by failure to branch, but also by being subject swiftly to cadaveric change (granulation). [E. E. S.]

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